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EDITOR'S COMMENT

THE present-day conception of the most satisfactory form of treatment of cancer of the uterus and adnexa is reflected in a group of abstracts from American and British clinics (pp. 495–497) appearing in this month's issue of the ABSTRACT. A report by Ward and Farrar of the results after five years obtained from radium treatment of cervical cancer (p. 463) and Opitz' discussion of the radiation biology of carcinoma (p. 497) are of especial interest in connection with the foregoing.

A symposium on the medical and surgical aspects of gastro-intestinal disease, particularly gastric and duodenal ulcer, presented at a recent meeting of the Iowa State Medical Society by Goldie (p. 446), Rendleman (p. 447), Dakin (p. 449), Hartwell and Dudley (p. 450) affords a comprehensive survey of a number of phases of this important subject. Balfour's review of five cases illustrating significant points in the management of lesions of the stomach and duodenum (p. 450), Eusterman, Berkman, and Swan's report of fifteen cases of primary carcinoma of the duodenum (p. 457), and Dixon, Burns, and Giffin's discussion of the possibilities of ileostomy as a therapeutic measure in cases of pernicious anæmia (p. 452) are other abstracts of importance to the gastro-enterologist.

A number of other important abstracts on various subjects of surgical interest merit especial mention. Buerger's discussion of the pathological aspects of diseases of the blood vessels of the extremities (p. 489) and Brown and Adson's report of calorimetric studies of the extremities following lumbar ramisection and ganglionectomy (p. 441) concern two phases of a problem which has aroused great interest in many surgical centers in recent years. Reid's extensive study of abnormal arteriovenous communications (pp. 144, 234, 486, 487) touches another side of blood-vessel surgery. A discussion on endocrine therapy by Brown, Vincent, Pugh, and others at a recent meeting of the Royal Society of Medicine of London (p. 498) is a helpful contribution to this much discussed subject. Herman and Carp's review of twenty cases of prostatic abscess (p. 475), and Gosset's description of the technique of choledochotomy for lithiasis (p. 455) include a number of helpful suggestions for the solution of two difficult problems.

Thoms' description of a method of measuring the superior pelvic strait by means of roentgen ray (p. 466) indicates the possibility of substituting an exact and accurate method for one involving several variable factors.

INTERNATIONAL ABSTRACT OF SURGERY

DECEMBER, 1925

ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

EYE

Parsons, Sir J. H.: The Foundations of Vision. *Lancet*, 1925, ccix, 123.

The Bowman Lecture for 1925 was delivered by Sir John Herbert Parsons. This honor has always been conferred upon eminent men and the lecture has always brought forth a classical dissertation of great practical importance. This year the very distinguished English ophthalmologist presented the facts and various theories of the physiology of vision. Beginning with the very lowest forms of life in which all reactions are purely utilitarian and hence concerned with the survival of the individual and species, he traced the development of vision in all of its aspects, including the motor and sensory responses and the epicritic differentiation of color appreciation. VIRGIL WESCOTT, M.D.

Funaishi, S.: The Treatment of Phlyctenular Inflammations of the Eye. *Am. J. Ophth.*, 1925, viii, 618.

Funaishi has produced phlyctenular disease by instillations of tuberculin, staphylococcus vaccine, tyraminum hydrochloride, and solutions of casein. As these substances sensitize the animals to the same and other proteins, Funaishi argues that phlyctenular disease can be treated best by the use of foreign proteins. He warns, however, that if the general and focal condition is not well studied, the indiscriminate use of a therapeutic measure which is not yet well understood may lead to serious consequences. VIRGIL WESCOTT, M.D.

Heckel, E. B., and Beinhauer, L. G.: Syphilitic Gumma of the Eyelid, Case Report. *Arch. Ophth.*, 1925, liv, 352.

Gumma confined to the eyelid is a rare condition but may occur either in the acquired or congenital form of syphilis. The authors report two cases. The first was that of a man 36 years old who denied lues but admitted neisserian infection complicated by bilateral buboes twenty years previously. Repeated dark-field examinations and Wassermann tests were negative. The pre-auricular, submaxillary, occipital, and cervical glands were involved. The patient died from pneumonia. The diagnosis of gumma was made by biopsy.

The second case was a case of congenital syphilis. The patient had been an inmate of a school for the blind because of an eye condition which caused blindness but improved under medical treatment. Besides the gumma on the eyelid, interstitial keratitis was present. Other stigmata of inherited syphilis were noted. The Wassermann test was negative, but the lid tumor underwent involution when mercury and salvarsan were used.

The article is supplemented by an extensive bibliography. VIRGIL WESCOTT, M.D.

Raia, V. L.: Toti's Operation for Dacryocystitis. *Am. J. Ophh.*, 1925, 3 s. viii, 547.

Since Toti described his operation of dacryocystorrhinostomy, Raia has performed twenty-eight of these operations. Twelve were reported in 1915 and sixteen are reported in this article. The patients who were considered cured immediately after the operation have remained cured. In the cases with improvement all discharge of pus and mucus has ceased but the tears continue to flow in the wind and in cold weather.

All of the operations were done under local anæsthesia. The author believes that the original incision is best despite the fact that others have objected to the deformity which it at first produces. He always packs the nostril on the side operated upon in order to prevent infection of the wound in the sac and the bony opening in the nose. According to Toti, the nasal mucous membrane should not be perforated but a disk of it should be removed. Any obstruction in the nose must be removed or the procedure will be a failure. The canaliculi and internal palpebral ligament must be left intact.

VIRGIL WESCOTT, M.D.

Fuchs, A.: The Anatomy of Inversion and Recession of the Iris. *Am. J. Ophth.*, 1925, viii, 601.

Fuchs states that in inversion the iris lies back upon the ciliary body, while in recession it is folded and incarcerated between the ciliary body and the lens.

In inversion, nothing can be seen of the iris at the point of inversion. In recession, the iris is greatly narrowed. Recession represents a slight degree of inversion and is a transitional stage between an inverted and a normally placed iris. These two conditions usually result from operation and injury.

VIRGIL WESCOTT, M.D.

Gifford, S. R.: The Properties of Lens Protein. *J. Am. M. Ass.*, 1925, lxxxv, 351.

It has long been noted by ophthalmic surgeons that certain eyes react very severely to liberated lens substance following rupture of the capsule and cataract extraction. Several years ago Verhoeff and Lemoine showed definitely that persons with such a reaction are unduly sensitive to lens protein but that after proper skin tests they can be desensitized and then operated upon without danger.

Gifford reports a series of cases studied along these lines and a series of experiments on rabbits and guinea pigs which confirm the work of Verhoeff and Lemoine. When the work was done on patients the subjects for operation were poorly chosen and the operative procedures not consistent with good surgical practice, but interesting results were recorded. Of the patients giving a positive skin test, only half had a reaction from lens substance, while of those with a negative skin test 10 per cent reacted to lens substance. Normal lens substance is toxic, and cataractous lens substance is more toxic.

Gifford suggests that the term "endophthalmitis phacogenetica" (Straub) be substituted for "endophthalmitis phaco-anaphylacta" (Verhoeff and Lemoine) because many of the reactions are not anaphylactic, being due to the toxicity of the lens matter itself.

VIRGIL WESCOTT, M.D.

Cruickshank, M. M.: Phacoeresis: Observations on the Technique, with a Report on 115 Consecutive Cases. *Brit. J. Ophth.*, 1925, ix, 321.

The author defines phacoeresis as follows: "Phacoeresis consists in withdrawing the crystalline lens complete in its capsule, by its anterior surface, from the eye, without either traction or violence to the zonula and extracting it completely without having produced ectopias or traumatism to intra-ocular structures."

He discusses a number of objections which have been raised to the operation and shows how, by the proper technique, the accidents and traumatism may be reduced to the minimum. He describes the operation in detail, including the instruments, the preparation of the patient, the operative technique, and the after-treatment. With regard to the insertion and application of the erisiphake to the lens he tells of the errors that are made most frequently and how they may be avoided. The article contains a large number of illustrations.

THOMAS D. ALLEN, M.D.

Pickard, R.: Cavernous Optic Atrophy and Its Relation to Glaucoma. *Brit. J. Ophth.*, 1925, ix, 385.

Pickard maintains that cavernous atrophy is a distinct entity and that its association with glaucoma is casual and not causal. It may occur without glaucoma, presenting symptoms somewhat resembling that disease, and it may occur with glaucoma but does not cause it.

Several cases are reported in which central vision varied from 6/6 to 6/45 and the fields were contracted but the red relatively more so as in optic atrophy. In all of the cases the cups occupied from 36 to 100 per cent of the area of the disk surface as measured by a method previously reported by the author. The depth of the cups ranged from 1.5 to 4 diopters and the tension from 15 to 27 Schiotz. In Pickard's opinion these cases are of the type called cavernous atrophy because of the large cups, low tension, and relatively contracted red fields.

VIRGIL WESCOTT, M.D.

Lagrange, H.: Derangements of the Organo-Vegetative Nervous System and of the Endocrinian System in Essential Glaucoma. *Brit. J. Ophth.*, 1925, ix, 398.

Lagrange reports a case of the "essential" type of glaucoma in contradistinction to the secondary type which demonstrates the relation of "neuropathic" influences to the condition. The patient was a woman 20 years of age. Menstruation had always been irregular. Ocular symptoms always accompanied the menses or occurred at such times as the menses should have appeared. The Goetsche test was positive. The tension was not controlled by eserine or pilocarpine but was finally reduced by intramuscular injection of adrenalin. After a series of intramuscular injections of corpus luteum the tension returned to normal and the pathological character of menstruation disappeared.

This case is of particular interest because of the presence of a Basedow syndrome, ovarian insufficiency, Raynaud's disease, and recurring attacks of glaucoma.

VIRGIL WESCOTT, M.D.

Gifford, H.: Miscellaneous Notes on Glaucoma. *Arch. Ophth.*, 1925, liv, 337.

During the last two years Gifford has seen five times as many patients with impairment of vision due to chronic glaucoma as patients with impairment of vision due to acute glaucoma. A great deal has been written regarding the differential diagnosis of acute glaucoma and iritis, but very little regarding the differentiation of chronic glaucoma. Testing the tension and field in every case of cataract would help to eliminate this complication. In cases in which a cataract becomes cured spontaneously a quiet glaucoma may alter the prognosis.

By following exactly the instructions given by Elliot, good results may be obtained. A poor trephine may be responsible for many failures. The heavy-handled trephine can be controlled better than a mechanically driven instrument.

In doing an iridotasis, Gifford nicks the pupil margin at one side and makes his incision practically as in the Lagrange operation. In comparing the two methods he states that in iridotasis the anterior chamber reforms more quickly. Following a fistulization operation there is always danger of choroidal detachment. In Gifford's opinion, the danger of infection in iris tissue well covered by smooth conjunctiva is neglible. Iridotasis probably causes a reduction in the tension by producing a fistula. Buphthalmos does not respond to a trephine operation.

Gifford has obtained one good result from anterior sclerectomy. An ordinary iridectomy is disastrous. When a patient has reached the age of 9 or 10 years any operation which causes the sudden escape of aqueous humor tends to produce intra-ocular hæmorrhage or retinal detachment.

Glaucoma following traumatic dislocation of the lens is very often due to prolapse of the vitreous body into the anterior chamber.

In the removal of cataractous lenses in previously trephined eyes the incision should not involve the bleb. To prevent late infections the author advises the use of a zinc chloride collyrium. In more than 300 cases in which a fistulizing operation was done exactly according to instructions he has seen only one serious infection. VIRGIL WESCOTT, M.D.

EAR

Quix, F. H.: The Function of the Vestibular Organ and the Clinical Examination of the Otolithic Apparatus. *J. Laryngol. & Otol.*, 1925, xl, 425, 493.

Quix says that examination of the otolithic function is more important than examination of the semicircular canals.

The otolithic organ is made up of the otolith, which is held in place by supporting threads, and the macula, which is separated from it by elastic substance. In the macula, supporting cells separate the hair cells which are encircled by fibers of the vestibular nerve. The normal stimulus is the pressure which the otolith exerts through the elastic substance on the hairs of the hair cells. This varies with position. It is responsible for: (1) the sensation of the position of the head in space; (2) reflex nausea; and (3) the reflex tonus of the muscles of the eyes, neck, trunk, and limbs. It gives rise to appropriate positions of the eyes and the body attitudes necessary to preserve static equilibrium. The reflexes of the semicircular canals, the kinetic sense organs, are of value during movement.

The plane of function of the utricular otoliths, the "lapilli," which are synergists, is the median sagittal plane, while the plane of function of the otoliths of the sacculi, the "sagittæ," which are mutually antagonistic, is the frontal plane.

The otolithic reflexes are best examined by the past-pointing test. In pointing in the sagittal plane, deviation is caused by stimulation of the sagittæ when: (1) the deviation persists above or below in the vertical axis, (2) disappears when the patient points in the frontal plane, and (3) changes in magnitude with rotation of the head on the sagittal axis to the shoulder; also when horizontal nystagmus is absent.

In pointing in the horizontal plane the deviation is due to an abnormal lapillus stimulation if: (1) the deviation is present when the patient points inward, absent when he points outward, absent when he points in the frontal plane, and changes in magnitude when the head is 30 degrees forward or 75 degrees backward. Deviation is downward from lapillus-macula stimulation and upward from its paralysis.

Disturbances in otolithic function explain most cases of giddiness from otitis media and disturbances in equilibrium or nystagmus with the head in certain positions. Otolith disturbance may occur after accidents, though canal tests are negative.

The macula sacculi is the most sensitive element of the internal ear, and its symptoms are the first to appear and the last to disappear.

Otoliths play the chief rôle in galvanization symptoms, sea-sickness, and the syndrome of Ménière.

Although the canals and otoliths co-operate, each has its own separate function.

THOMAS C. GALLOWAY, M.D.

Mygind, S. H.: How Does the Caloric Nystagmus Arise? *J. Laryngol. & Otol.*, 1925, xl, 444.

In Mygind's opinion caloric nystagmus consists of two reactions, one from the semicircular canals and the other from the otoliths. The former gives a reversion on forward bending, while the other does not. The canal reaction is explained by Bárány's theory of movement due to a change in the specific gravity. The otolith reaction is attributed to a change in tonus of the otolith organs which is increased by warming and decreased by cooling.

Normally, with the head upright or inclined to the side, the otoliths and canals react interdependently. In forward bending, they are dissociated, the canal reaction being usually decisive.

The otolith reaction is asserted only when the function of the canals is arrested or diminished. This theory will explain the great variation in pathological cases and indicate why, with the cold caloric, a vertical nystagmus downward may occur with forward bending or a vertical nystagmus upward with the head upright.

The spontaneous otolith reaction—nystagmus produced in certain positions independent of the movement through which the position was obtained—seems reflected in the caloric reactions in these cases. However, the author cannot reconcile this theory with Borries' finding of reversion by forward bending in pigeons whose semicircular canals were apparently removed. THOMAS C. GALLOWAY, M.D.

Shambaugh, G. E.: A Discussion of Some of the Clinical Problems of Chronic Suppurative Otitis Media. *Laryngoscope*, 1925, xxxv, 593.

The author is of the opinion that one of the chief advances in otology is the more accurate recognition of the indications for the radical mastoid operation. Chronic otitis media is of two types—one in which there are elements of danger and the other with practically no danger. The former invades the bone while the latter is restricted to the lining membranes of the middle ear cavities. Radical operation is indicated only in the type with bone invasion.

The object of the radical mastoid operation is the eradication of the focus of infection. It is of advantage to have the eustachian tube closed off, but this is by no means necessary. A little discharge from the tube is of no significance.

JAMES C. BRASWELL, M.D.

Granger, A.: A New Device and Technique for Making Radiographs of the Mastoids in the Law and in the Arcelin Positions. *Radiology*, 1925, v, 44.

While recognizing the value of the Law and Arcelin positions for making roentgenograms of the mastoid, Granger had experienced difficulty in duplicating these positions. He attributed this to the difficulty of accurately centering the rays when the tube was tilted at the required angles and of placing the two mastoids in identically the same position on the cassette.

To overcome these difficulties he applied the same principle of angle blocks and a vertical ray that had proved successful in his sinus work. He has perfected a device that fulfills the requirements of tilting the head by angle blocks so that a vertical ray may be used. With this device he employs also constant points of contact, the alveola and the glabella. In this way, the head is fixed and steadied so that duplicate positions of the two mastoids may be obtained.

The article contains numerous illustrations showing the new device, the method of using it, and the uniformity of the roentgenograms obtained. Any description of the new device and technique would be inadequate without these illustrations.

CHARLES H. HEACOCK, M.D.

NOSE AND SINUSES

Pfahler, G. E.: Electrocoagulation and Radiation Therapy in Malignant Disease of the Ear, Nose, and Throat. *J. Am. M. Ass.*, 1925, lxxxv, 344.

In the treatment of malignant disease of the ear, nose, and throat the use of electrocoagulation is limited because it may destroy the blood vessels or other essential tissue, it requires anæsthesia and the guidance of the eye, and it is followed by sloughing. Radiation is of value before, after, or without operation, and should always be employed with electrocoagulation. Radium is preferable to the X-ray when it can be brought into contact with the malignant growth or inserted in it, but the roentgen ray is preferable to radium when the neoplasm goes deeper than 2 cm. or lies under healthy tissue. In the use of the X-ray, Pfahler employs a daily "saturation" method. Great care is necessary in the dosage.

Malignant disease of the ear which is confined to the skin responds to electrodesiccation and radium treatment. When cartilage or deeper tissue is invaded, only radiation is effective.

Epitheliomata of the nasal mucous membrane are best treated with radium. Sarcomata should be treated with radium and crossfiring. In malignancy of the antrum, radium is used in the nose, mouth, and nasopharynx with high-voltage crossfiring, and surgery and electrocoagulation are employed as adjuncts.

Fibromata of the nasopharynx and sarcomata of the throat are best treated by radiation. In the early stages of carcinoma of the tonsils, radiation may give brilliant results, and in the later stages may give marked palliation. In carcinoma of the larynx the effect of daily radiation has been encouraging. Pfahler has had no experience with electrocoagulation in these cases, but cites Novak's 200 cases in which this treatment was without untoward sequelæ.

THOMAS C. GALLOWAY, M.D.

Davis, W. B.: Paranasal Sinusitis in Children. *Atlantic M. J.*, 1925, xxviii, 736.

Paranasal sinusitis occurs more frequently in children than is generally recognized, and usually follows acute colds, or the acute infectious diseases of childhood, influenza, pneumonia, and diphtheria. Occasionally it is the result of intranasal obstructions. The great majority of acute and subacute cases respond to conservative treatment. If operative procedures are necessary they should be limited in order to avoid interfering with nasal development and causing external deformities. The removal of infected tonsils and enlarged adenoids decreases nasal congestion and consequently improves the ventilation and drainage of the sinuses. The author believes that closer co-operation between pediatrists and rhinologists would shorten the duration of many sinus infections.

GEORGE R. MCAULIFF, M.D.

Dean, L. W.: Paranasal Sinus Disease in Children. *J. Am. M. Ass.*, 1925, lxxxv, 317.

Complications of sinus disease in early life include otitis media, ocular disease, arthritis, laryngitis, bronchitis, pneumonia, periodic vomiting, local bony necrosis, cavernous sinus phlebitis, meningitis, brain abscess, and kidney and heart disease.

The symptoms include a nasal discharge, blocking of the nose, sneezing, listlessness, a poor color, repeated colds, and the symptoms of the secondary infection. The X-ray is used chiefly to determine the degree of sinus development, but also reveals the evidence of disease. The final test in the diagnosis is microscopic and cultural examination of the secretion aspirated through a puncture needle.

Removal of the tonsils and adenoids will cure 80 per cent of cases of sinus disease. Dietary measures, and especially foods containing the fat-soluble Vitamin A, are most important. A dry sunny climate may have a very beneficial effect. Locally, hot irrigations and protargin or mercurochrome are used. Antrum puncture and irrigation frequently effect a cure. If this treatment fails, an antromeatal opening is made. THOMAS C. GALLOWAY, M.D.

Shea, J. J.: The End-Results of Sinus Surgery in Children. *Arch. Otolaryngol.*, 1925, ii, 111.

The end-results of sinus surgery in children have been satisfactory. Radical measures are seldom necessary. The author has found that removal of the tonsils and adenoids will cure most cases of sinusitis in children and therefore always includes it in his treatment. Drainage of the antrum, the most common procedure in sinus surgery, is done under anæsthesia induced with ether, or, if ether is contra-indicated, with nitrous oxide or ethylene. An antrum trocar is inserted under the inferior turbinate and after opening up well, a rubber drainage tube is inserted and allowed to remain in place for five or six days. Irrigation is done with a 10 per cent solution of protargin mild. This treatment has proved beneficial in acute laryngitis and bronchitis, nephritis, pyelitis, myocarditis, asthma, arthritis, cyclic vomiting, ozæna, diabetes, and the cases of neurotic children. GEORGE R. MCAULIFF, M.D.

McKenzie, D.: Acute Pulmonary Infection Following Operation on the Maxillary Antrum. *Proc. Roy. Soc. Med.*, Lond., 1925, xviii, Sect. Laryngol., 50.

The author performed a double nasal antrostomy upon a man 33 years of age. Pleurisy on the right side set in six days later and was followed by general bronchopneumonia and several attacks of hæmoptysis. The temperature rose and remained elevated with daily remissions for about eight weeks. Following the drainage of an empyema, recovery resulted. The sputum was free from tubercle bacillus.

Several cases of acute pulmonary infection of various kinds have come under the author's observation. In every case the maxillary antrum was the site of operation. The route by which the infection reaches the lungs is not obvious. The septic material may be inspirated or may travel through the venous channels. The usual septic sequela of operation on the nose is acute tonsillitis. This may be terminated by a 25-c.cm. dose of antistreptococcus serum. JAMES C. BRASWELL, M.D.

MOUTH

Schleicher, H.: The Nature and Etiology of Lingual Carcinomata, with Special Reference to the Etiological Importance of Lues (Wesen und Aetologie des Zungencarcinoms mit spezieller Pruefung der aetologischen Rolle der Lues). *Ztschr. f. Krebsforsch.*, 1925, xxii, 144.

On the basis of forty-four cases of carcinoma of the tongue the author reviews the different forms of origin of this carcinoma and then discusses in detail the clinical picture of the lesion.

Carcinoma of the tongue appears most frequently along the margin of or at the base of the tongue. It is always a squamous-cell epithelioma. It forms metastases in the regional lymph glands very early. Metastases in other organs are extremely rare. The most important glands involved are the deep cervicals which lie on the jugular vein at the level of the bifurcation of the carotid. Metastases are frequently bilateral. Of the forty-four cases reviewed, twenty-nine showed metastases.

The symptoms of the carcinoma depend upon its site and extent. In the differential diagnosis, gummata, deep tuberculous nodules, actinomycosis, sarcoma, benign tumors, and ultimately decubitus ulcers must be considered. It is important to recognize the fact that lues and carcinoma may be present simultaneously. The prognosis of carcinoma of the tongue is generally poor; it is relatively good only when operation is performed early.

Etiological factors include long-continued irritation, wounds, and scars. Leucoplakia was present in 16.6 per cent of the cases reviewed, and lues in 26.3 per cent of the cases reviewed. Smoking and the use of alcohol seem to play only a minor part. Heredity is not of much importance. The lesion is more common in men than in women. Its incidence increases after the fortieth year of life and reaches its maximum between the sixty-first and seventieth years.

The author concludes that lues is not an important factor in the etiology; that, on the contrary, it is only one of a number of indirect causes of equal importance.

The histories of the forty-four cases reviewed are reported briefly. VON TAPPEINER (Z).

PHARYNX

Sheehan, J. E.: The Repair of Inoperable Soft Palate. *Med. J. & Rec.*, 1925, cxxii, 185.

In the technique described the incision is begun above the superior horizontal line of the faucial tonsil and carried well toward the cheek, thence directly downward across the tonsil to include its upper two thirds, then backward over the posterior pillar to include about ¼ in. of the pharyngeal membrane, and then up to a point on a level with its beginning. The edges of the flap to be brought up are thus outlined.

The muscle, membrane, and tonsillar tissue within these borders is deeply separated by the use of semicurved scissors with blunt ends and the flaps are drawn up for suturing along the median line. Beginning at the back, the needle enters about ⅛ in. from the free membranous border and is carried back until it includes a generous portion of the muscular filaments which form the posterior pillar. It is then brought out and carried to the opposite side where it first enters the muscles of the posterior pillar and is then carried forward to the membra-

nous border and out. This suture forms the first stay of the palate in its new position.

The tonsillar materials from the two sides are joined with three mattress sutures and the membranes of the anterior pillars are brought together in the same way as those of the posterior areas, the suture passing through the palatoglossal muscle to establish the stay on this side. The surface of the new palate is then established by bringing together, underneath, the membranes from front and back and joining them with several horsehair sutures. In order to prevent destructive contractures the raw areas are covered with a Thiersch graft. The grafts are held in position by a splint mould.

JAMES C. BRASWELL, M.D.

NECK

Crawford, J. H., and Hartley, J. N. J.: The Influence of the Autonomic Nervous System on the Function of the Thyroid Gland. *J. Exper. Med.*, 1925, xlii, 179.

Crawford, J. H., and Hartley, J. N. J.: The Histological Changes in the Thyroid Gland of the Rabbit Following Lobectomy. *J. Exper. Med.*, 1925, xlii, 193.

The authors state that there is a marked variation in the histological structure of the thyroid glands of different rabbits examined at the same season under standard conditions, but the structure of the two lobes in the same animal does not differ. The variations are noted principally in the size and shape of the vesicles and the quantity and character of the colloid.

With one lobe as a control, no histological changes in the other lobe were observed following section or stimulation of either the cervical sympathetic nerve or the vagus and its branches.

SAMUEL KAHN, M.D.

Jordan, S. M.: Basal Metabolic Rates and Their Relation to End-Results in Thyroid Disease: A Statistical Study. *Arch. Surg.*, 1925, xi, 1.

In the treatment of thyroid disease the determination of the basal metabolic rate is of undoubted value for the following purposes:

1. To differentiate between hyperthyroidism and other conditions simulating this condition, especially neurocirculatory asthenia.

2. To differentiate between tumors of the thyroid with and without hyperthyroidism.

3. To aid in the estimation of the severity of primary and secondary hyperthyroidism and thereby obtain data which will be helpful in the decision as to the extent of operative procedures in the treatment of the condition.

4. To estimate the adequacy of surgical treatment and the necessity for further treatment when the usual procedure proves inadequate.

5. To guide the treatment of myxœdema.

In over 1,000 cases reviewed the clinical results of surgical treatment were indicated by changes in the metabolic rate.

SAMUEL KAHN, M.D.

Falk, H. C.: The Relationship Between the Pathological and Clinical Aspects of the Diseases of the Thyroid Gland. *Arch. Surg.*, 1925, xi, 74.

From the standpoint of treatment, the diseases of the thyroid gland may be divided into three groups: (1) those requiring only medical measures, (2) those requiring both medical and surgical treatment, and (3) those requiring surgery. Conditions which are purely medical are cretinism, myxœdema, and adolescent goiter. Those requiring both medical and surgical treatment are exophthalmic goiter, colloid goiter, with or without toxic symptoms, cretinism with goiter, congenital goiter, acute thyroiditis, and acute strumitis. Strictly surgical conditions are adenomata, toxic and non-toxic thyroid enlargements causing obstruction, and malignant growths.

In every case in which a clinical diagnosis of exophthalmic goiter was made a definite pathological picture was observed, viz., hypertrophy and hyperplasia of the epithelium, papillary-like ingrowths, an increase in the size and number of the blood vessels, and a scant and thin colloid.

The various forms of goiter that are present for from eight to sixteen years before they produce marked toxic symptoms are not classified as exophthalmic goiter, even though the clinical syndrome is practically the same as that seen in exophthalmic goiter. These two syndromes must be clearly differentiated from each other because the pathological changes upon which they are based and the treatment indicated for their relief are dissimilar.

The author describes the histological picture of the different types of thyroid diseases and illustrates his discussion with photomicrographs.

HOWARD A. MCKNIGHT, M.D.

Key, J. A.: The Secretion Antecedents and Mitochondria in Pathological Thyroids: A Theory of the Mode of Secretion in the Thyroid Gland. *Arch. Surg.*, 1925, xi, 254.

Following a description of the histology of the normal thyroid in animals and in man the author discusses the changes in the pathological gland, including simple adenoma, fetal adenoma, exophthalmic goiter, and malignant tumors. Secretory phenomena are discussed separately

Photomicrographs to show the cellular structure in the different types of goiter are presented; also tables giving the age, the duration of the goiter, the basal metabolism, the size of the follicles, the amount of stroma, parenchyma, and colloid, the vacuoles in the colloid, the size of the cells, the mitochondria in the cells, the chromophobe and chromophil secretion in the cells in the various kinds of goiter.

In all of the pathological glands studied it was possible to make the diagnosis quite as accurately from the examination of sections fixed in Zenker's fluid and stained with hæmatoxylin and eosin as it was by studying the mitochondrial preparations. For routine work, a study of the amount of parenchyma, the character of the stroma, the size of the cells, the character of the colloid, and the vacuoles

in the colloid is of more value than a study of the mitochondria of the gland. In many pathological thyroids, it is difficult to obtain good mitochondrial stains, and poor preparations are apt to be misleading. Unfortunately, none of the unusual exophthalmic goiters which resemble the normal adult thyroid histologically were encountered in the series studied. A cytological study of a gland of this type would be extremely interesting.

The author's findings and conclusions are summarized as follows:

1. Chromophil granules and chromophobe vacuoles can be demonstrated in the cells of normal and pathological thyroids.
2. It is believed that these are the secretion antecedents, and that the colloid is a mixture of the two.
3. The chromophil granules vary independently of the activity of the gland and do not contain the active principle of the thyroid.
4. The chromophobe vacuoles vary directly with the activity of the gland and contain the active principle of the thyroid.
5. No abnormal secretory antecedents were demonstrable in either toxic adenomata or exophthalmic goiters.
6. All hyperactive glands examined contained an excess of the normal chromophobe secretion.
7. The mitochondria were present in the living cells of all glands studied and were increased in the cells of all hyperactive glands.
8. The secretory antecedents do not arise directly from the mitochondria.
9. Mitochondria probably have some function in connection with the general metabolism of protoplasm and are not responsible for the specific activities of the cells that contain them.

CARL R. STEINKE, M.D.

Davidson, J. R.: A Case of Adolescent Myxœdema Accompanied by Nephrosis and by Tetany of Parathyroid Origin Treated with Thyroid and Collip's Parathyroid Extract. *Canadian M. Ass. J.*, 1925, xv, 803.

In the case of an adolescent girl with recurring convulsions, œdema, and a low content of calcium in the blood, a clinical diagnosis of myxœdema complicated by nephrosis and subparathyroid tetany was made. Under treatment with desiccated thyroid (Frost's tablet of 0.2 per cent iodine three times a day) and calcium chloride (5 gr. six times a day) with a balanced full diet including a generous supply of milk and fresh fruit, the myxœdematous symptoms almost disappeared, the mental condition improved, and the convulsions markedly diminished.

Subsequently the calcium chloride was discontinued and Collip's serum (ox parathyroid extract) was injected subcutaneously daily in sufficient dosage (2 to 4 c.cm.) to maintain the blood-serum calcium balance between 10.9 and 11.5 mgm. per 100 c.cm. Under this treatment, which was continued at intervals for several years, the convulsions were controlled almost completely, and the symptoms steadily decreased. However, the patient's extraordinary susceptibility to intercurrent infections complicated the treatment, caused the recurrence of the symptoms, and made necessary her re-admission to the hospital. The patient recovered from a series of infections, including influenza, otitis media, rubella rash with enlargement of the cervical glands, and diphtheria. Several years later she died of an acute infection.

Autopsy showed a small atrophic, pale, inactive thyroid gland with acini filled with colloid and lined with low cuboidal epithelium and with increased fibrous tissue and thickened blood vessels. There were no parathyroids in the normal position at the upper and lower poles, but in the median position there were two, the left one of which was somewhat atrophied. Chronic nephrosis was also found.

In Davidson's opinion, the condition was controlled by the thyroid therapy so that the basal metabolic rate was kept within normal limits and, provided the dosage of parathyroid extract (Collip) was properly adjusted, the serum calcium was maintained between 10 and 11.5 mgm. per 100 c.cm. Under these conditions the convulsions of tetany gradually ceased and did not recur until some infection disturbed the equilibrium. When the œdema was severe the immediate response to the serum calcium seemed less marked. The fact that the treatment with parathyroid extract was continued for five months without causing untoward symptoms proves that the dosage employed is safe. The case is evidence also of the efficacy of Collip's extract in the control of tetany of parathyroid origin.

WALTER C. BURKET, M.D.

Shaw, A. F. B., and Smith, R. P.: Riedel's Chronic Thyroiditis: with a Report of Six Cases and a Contribution to the Pathology. *Brit. J. Surg.*, 1925, xiii, 93.

Riedel's chronic thyroiditis is characterized by the appearance in the thyroid of an extremely hard tumor involving all or only a part of the gland. The condition is insidious in onset, at first causing no symptoms. Pain is rare, but the tumor tends to become adherent to, or to invade the surrounding structures, causing pressure. Clinically, the condition resembles cancer, and as a rule a diagnosis of malignancy is made. A cut section of the gland is hard, smooth, creamy-white, and opaque. Microscopically there is no evidence of malignancy. Surgical treatment alone is successful. Thyroidectomy results in a complete cure, but extensive adhesions may render operation difficult, dangerous, or even impossible.

The authors report six cases observed during the past few years, with a detailed description of the histological findings. The patients were women between the ages of 32 and 58 years. In three cases the condition was in the early stages, showing a peculiar round-cell infiltration confined to the interior of the gland and no appreciable fibrosis. In the three others it was advanced, having extended

outside of the thyroid gland, though not sufficiently to prevent removal, and fibrosis was present. In two of the early cases there were no symptoms, but in the remaining four there were symptoms of compression. A diagnosis of carcinoma was made clinically in five of the six cases and microscopically in one. Partial removal cured two cases with local enlargement, but failed to cure one case with involvement of the entire gland. Total thyroidectomy cured two cases with general enlargement.

Microscopic examination shows first a diffuse round-cell infiltration with the formation of lymph follicles containing germ centers. Increased functional activity of the acinar cells is followed by their degeneration and replacement by fibrosis. Compensatory epithelial hypertrophy or foci of adenomatous hyperplasia appear. The process is presumably an inflammatory one rather than a simple lymphoid overgrowth. There is nothing to support the assumption that it is due to syphilis. The condition early extends through the capsule and invades the neighboring structures, binding them together in a mass of fibrous tissue and causing symptoms from compression.

The authors have collected and tabulated twenty-three cases from the literature, but conclude that the disease is more frequent than is generally believed, and that many cases of thyroid "cancer," if adequately studied, would prove to be cases of Riedel's struma. LEO M. ZIMMERMAN, M.D.

Schultze, H.: A Case of Chylothorax Due to Compression of the Thoracic Duct by a Substernal Goiter (Ueber einen Fall von Chylothorax hervorgerufen durch Kompression der Muendungsstelle des Ductus thoracious durch eine Struma substernalis). *Wien. klin. Wchnschr.*, 1925, xxxviii, 455.

The author reports a case of substernal goiter which compressed the thoracic duct and caused death. During the long period of the illness there were signs of severe injury to the heart muscle and a marked tendency toward the development of general œdema. Roentgen diagnosis failed. Paracentesis of the pleura evacuated a chyle-like, milky fluid which was believed to come from the thoracic duct. This assumption was found to be correct. Autopsy revealed also an old thrombosis of the innominate and left jugular veins, endocarditis, and compression of the thoracic duct by a knot of colloid struma the size of a walnut which had caused marked dilatation of the thoracic duct and chylothorax.

LOEHR (Z).

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Yerger, C. F.: The Cerebrospinal Fluid as an Index of Otorhinogenic Intracranial Complications. *J. Am. M. Ass.*, 1925, lxxxv, 424.

The author's study was based on a series of 155 cases of meningitis, forty-three cases of lateral sinus thrombosis, thirty-five cases of brain abscess, eight cases of labyrinthitis, four cases of extradural abscess, two cases of cavernous sinus thrombosis, and one case of subdural abscess.

Yerger concludes that in the majority of cases the cerebrospinal fluid is a reliable index of intracranial complications of otorhinogenic origin, such as meningitis, brain abscess, and subdural and extradural abscess. It is of value also in the prognosis and treatment. In some cases, however, it may be misleading and should not be relied upon to the extent of excluding from consideration other clinical signs indicative of intracranial involvement. The knowledge gained from an examination of the cerebrospinal fluid may be of value in either a positive or a negative sense. Frequently it is necessary to repeat the examination. JAMES C. BRASWELL, M.D.

Putnam, T. J., and Cushing, H.: Chronic Subdural Hæmatoma: Its Pathology, Relation to Pachymeningitis Hæmorrhagica, and Surgical Treatment. *Arch. Surg.*, 1925, ii, 329.

In the cases of certain persons an apparently insignificant trauma to the head may be followed, after a latent interval varying from a few hours to months or even years, by symptoms of cortical irritation and intracranial pressure due to a subdural hæmatoma. These cases are less rare than was formerly supposed.

Clinically, after a period of headache, the patient shows an extraordinary variability of symptoms, particularly in the intellectual sphere. He is apt to develop a psychosis and often becomes irritable, indecent, and unmanageable. Choked disk is apt to be present, and a frontal lobe tumor is suspected.

At operation or autopsy a subdural hæmatoma will be found on one or both sides, enclosed in a continuous membrane slightly adherent to the dura but not adherent to the arachnoid.

The enveloping membrane on the side toward the arachnoid is thin and covered with mesothelium. On the dural side it is more dense and composed of organizing granulation tissue containing large mesothelium-lined spaces containing blood and fibrin which appear to anastomose with each other and with the capillaries.

In this respect, the membrane of the traumatic hæmatoma seemingly differs from that of the commonly described pachymeningitis hæmorrhagica interna, in which the thin-walled vessels are enormous and no mesothelium-lined spaces are seen. Such a pachymeningitic membrane may possibly give rise to hæmatomata which symptomatically and in the gross resemble the posttraumatic variety.

In certain cases in which the onset of symptoms is delayed for only a few days after the injury, it is possible that they may be due to a hæmatoma which is formed immediately but announces its presence only when the brain becomes œdematous or congested.

In other cases the occurrence of late hæmorrhages seems probable and may be due to the formation of communications between the mesothelium-lined spaces and blood vessels, with rupture of one or the other.

The spontaneous pachymeningitis vasculosa may represent a chronic form of the same process. There is no satisfactory evidence that either form is inflammatory or neoplastic.

The term "reactive pachymeningitis" might be used to designate the peculiar process of organization which is evoked by the presence of a blood clot or other collection of fibrin on the inner surface of the dura and may give rise to secondary hæmorrhages.

When the presence of a subdural hæmatoma is suspected an exploratory craniodural puncture over the hemisphere will give the most reliable evidence of the presence or absence of a clot. This should be bilateral. A lumbar puncture may show a faint xanthochromic fluid, but often the cerebrospinal fluid is negative.

If the diagnosis is verified, the procedure of choice is an osteoplastic resection with reflection of the dura, removal of the more or less organized clot as intact as possible, and subsequent careful hæmostasis. It is necessary to remove the dura as it may be a possible source of further hæmorrhage.

Experience indicates that there need be no fear of re-formation of the clot but that cerebral œdema is apt to occur in the brain released from long pressure. Consequently it may be advisable to combine the osteoplastic exploration with a subtemporal decompression.

If œdema occurs, the use of hypertonic saline solution or the performance of lumbar puncture should perhaps be resorted to before re-investigation of the wound. CYRIL J. GLASPEL, M.D.

Borchardt, M.: The Surgical Significance of Aneurisms of the Brain (Die chirurgische Bedeutung der Gehirnaneurysmen). *Beitr. z. klin. Chir.*, 1925, cxxxiii, 429.

Borchardt discusses the pathology of aneurism of the brain from the standpoint of the surgeon on the

basis of two cases, one of which was operated upon under the probable diagnosis of brain abscess located in the motor area following grippe, and the other under the diagnosis of a tumor or meningeal process (aneurism?) of the left central convolution. These cases he reports in detail. Both of the patients died shortly after the operation. The anatomical findings in aneurism of the brain as reported in the literature are reviewed.

The author then discusses the clinical picture of this disease, which resembles that of brain tumor as far as the symptoms of displacement and the pressure changes are concerned, but nevertheless presents a number of peculiarities which, to a certain extent, are characteristic of aneurism and may prove valuable in the differential diagnosis. Whether or not there are symptoms which will allow localization of the intracranial process depends entirely upon the situation of the aneurism and the hæmorrhage.

If an aneurismal hæmorrhage ceases, coagulation sets in, the collection of blood diminishes in size, the compressed brain again expands, and there may be improvement in the patient's condition until another hæmorrhage occurs. While such a course of clinical phenomena in the form of recurrences and aggravated attacks is not pathognomonic, it is highly suggestive of aneurism of the brain. Frequently the choked disk and slowing of the pulse—the latter observed only during the time of hæmorrhage—are absent. The attacks of hæmorrhage are occasionally associated with a high temperature. An extremely important sign is the occurrence of rigidity of the neck which, in contrast to that of meningitis, develops not gradually, but suddenly and coincidently with the first brain symptoms. The spinal puncture shows a more or less blood-tinged cerebrospinal fluid.

Aneurism of the internal carotid artery gives a somewhat characteristic picture. In this condition the ocular disturbances, which may frequently be traced back for years, are of special importance. According to their course, three types of cases may be distinguished: the first includes those that run an entirely asymptomatic course; the second group, those in which death occurs with severe brain symptoms at the time of the first central hæmorrhage; and the third, those with repeated attacks or recurrences covering a period of weeks, months, or years. In these cases of aneurism of the brain the surgeon is able to render assistance only if a correct diagnosis is made. A correct diagnosis has been made only seven times. The prognosis of true aneurism of the brain is always grave.

In addition to the two cases reported, surgical interference was undertaken by the author also in others, the findings and histories of which are briefly given. Only two of the patients are still alive.

BODE (Z).

Dandy, W. E.: Intracranial Tumors and Hydrocephalus. *Ann. Surg.*, 1925, lxxxii, 199.

The author contends that as the causative lesion of hydrocephalus can be demonstrated not only at autopsy but also during life by clinical methods, there is no longer any justification for the term "idiopathic hydrocephalus."

From the standpoint of therapy, hydrocephalus is of two types: (1) that with communication, and (2) that without communication, depending upon the presence or absence of communication of the cerebral ventricles with the subarachnoid space. The differentiation of type is made by the injection of 1 c.cm. of neutral phenolsulphonephthalein into the spinal canal and testing for the color in the ventricular fluid from fifteen to twenty minutes later.

The reports of three cases show that tumors and abscesses may be etiological factors in the production of the communicating type of hydrocephalus. In each of the three cases the cisterna pontis was completely blocked, a finding which corroborates the experimental observation that constriction around the pons or mid-brain occluding the cisterna produces hydrocephalus of the communicating type.

WILLIAM E. SHACKLETON, M.D.

MacCready, P. B.: Bilateral Recurrent Nerve Paralysis Due to Aortic Aneurism: Report of a Case with Histological Sections of the Recurrent Nerves. *Arch. Otolaryngol.*, 1925, ii, 122.

The patient whose case is reported was a muscular, well-built, somewhat undernourished colored man 40 years of age who, six months previous to his admission to the hospital, experienced dyspnœa, pain over the sternum, and difficulty in talking and swallowing. He continued to work, however, until two days before his admission, when he became very weak.

At examination, it was found that the respiratory distress was particularly severe when the patient assumed the recumbent position. Respiration was of the wheezy, asthmatic type, and there was a brassy cough. The voice was hoarse and high pitched. The thorax was symmetrically barrel shaped. No abnormal pulsations were noted. Respirations were 20 and prolonged. The lungs were resonant. Sonorous râles were noted throughout the chest. The heart was enlarged toward the left. A systolic thrill was noted at the apex. The heart sounds were clear, with no murmurs. The second aortic sound was greater than the second pulmonic sound.

Retromanubrial dulness was increased in width. The radial pulses were 72, synchronous, and regular. The blood pressure was 132-90. The right pupil was larger than the left, but both reacted to light and accommodation. Middle ear deafness was present. The Wassermann test was negative. The superficial and deep reflexes were sluggish. The vocal cords were symmetrically fixed in a position of adduction but not quite approximated; they showed no definite movement with respiration and only a questionable amount of adduction on phonation. The arytenoids were in the normal position. A diagnosis of bilateral posticus palsy was made.

During low tracheotomy under local anæsthesia a definite tracheal tug was elicited. The X-ray

showed a large dense shadow in the mediastinum and marked displacement of the trachea to the right. The tumor did not pulsate during the fluoroscopic examination. After tracheotomy the stridor was much less marked, but bronchopneumonia developed and caused death.

Autopsy showed an aneurism of the aortic arch; marked syphilitic aortitis in the region of the aneurism; compression of the œsophagus; extensive bilateral confluent lobular pneumonia with acute fibrinous pleurisy; healed ulceration of the colon; and caseous mesocolic and bronchial lymph nodes.

The aneurism arose from the posterior part of the aortic arch. It was the size of a large orange, bilobed, and adherent to the œsophagus and trachea. The trachea was deflected to the right, and 4 cm. above the bifurcation showed marked flattening. The left recurrent nerve passed around the left lobe of the aneurism and was spread out and bound in scar tissue at the point where the aneurism was adherent to the œsophagus. The right recurrent nerve was compressed between the trachea and the innominate artery.

In microscopic sections the right recurrent nerve distal to the aneurism showed complete degeneration of all fibers; the left recurrent nerve had only a few normal fibers. Sections of both nerves proximal to the aneurism presented no degenerated fibers.

Symmetrical bilateral paralysis of the vocal cords due to thoracic aneurism is rare. Tabes, the most common cause of bilateral abductor palsy, was not present in the case reported. In complete paralysis after goiter operations, the cord is also in the adductor rather than the cadaveric position. Inspiratory stridor, which is usually assumed to be due to abductor palsy and as a rule is not associated with complete paralysis, cannot be accepted as a definite sign of abductor palsy. WALTER C. BURKET, M.D.

PERIPHERAL NERVES

Laewen, A.: Nerve Freezing for Amputation, Amputation Neuromata, Angiospasm, Erythromelalgia, Senile Gangrene, and Varicose Ulcer of the Leg (Ueber Nervenvereisung bei Amputationen, Amputationsneuromen, Angiospasmen, Erythromelalgie, seniler Gangraen, und Ulcus cruris varicosum). *Beitr. z. klin. Chir.*, 1925, cxxxiii, 405.

The author reports the results of nerve freezing in fifty-two cases. The apparatus used permits the simultaneous freezing of five nerve trunks. The time necessary for complete freezing averages fifteen minutes. Regeneration occurs more quickly than after cutting as there is no scar tissue to hinder it. In man, regeneration seldom requires longer than six months even in unfavorable cases, but in Laewen's cases in which the sciatic nerve and other thick nerves were involved two years elapsed before complete recovery occurred.

In fresh amputation cases nerve freezing has three purposes: (1) the prevention of pain during healing, (2) the production of a painless stump, and (3) the prevention of amputation neuromata.

In one group of cases the freezing was done at the site of the amputation wound. The end-results were, in general, favorable. In one instance, however, a neuroma occurred in spite of freezing and transplantation into the muscles.

In another group of cases the freezing was done above the site of the amputation. The healing of the wound was painless but certain sensations were perceived.

In the third group of cases the freezing was done high up because of the presence of amputation neuromata. The result was favorable in six cases and unfavorable in one. In the latter the cause of the symptoms was probably higher than the site of the freezing. Of three patients who were traced for a considerable length of time one was still free from symptoms three and a quarter years later and the other two years later. Trophic disturbances and marked muscle atrophy were never observed.

In three recent cases the attempt was made to cure or relieve the pain of arteriosclerotic gangrene.

With regard to the effects of nerve freezing upon the circulation the author states that there was a slight rise in the skin temperature.

A patient who was subjected to nerve freezing because of angiospastic attacks of pain has been free from pain for three years and ten months in spite of the fact that anæsthesia has disappeared. In another case, however, the result was negative. In a case of severe erythromelalgia a good result was obtained.

In conclusion the author states that in the case of the saphenous nerve it is very difficult to judge the results of freezing as this nerve is very difficult to influence in its entirety. KULENKAMPFF (Z).

SYMPATHETIC NERVES

Brown, G. E., and Adson, A. W.: Calorimetric Studies of the Extremities Following Lumbar Sympathetic Ramisection and Ganglionectomy. *Am. J. M. Sc.*, 1925, clxx, 232.

The authors studied the vasomotor effects of ramisection by determining the skin temperature, the heat production, and the radiation of the lower extremities before and after operation in five cases of spastic paraplegia in which the second, third, and fourth lumbar sympathetic ganglia with the sympathetic trunk were removed without causing any serious complications of the hypogastric plexus. The technique for the left side is similar to that for the right side except that if the sigmoid is firmly fixed in the left iliac fossa, it is necessary to mobilize it by opening the peritoneum laterally to the sigmoid attachment; it may then be elevated and displaced mesially, the ureter being again exposed and retracted outward and the lower portion of the abdominal aorta and the common iliac artery being elevated to expose the sympathetic ganglia, trunk, and rami. The latter may then be removed as on the right side, with care to divide the sympathetic trunk above the second lumbar sympathetic ganglia and below the fourth lumbar sympathetic ganglia.

In order to determine the effects of this operation on the vasomotor nerves, the following study was carried out in part or in whole before operation was performed, and for variable periods after the operation:

1. Skin temperature determinations were made by means of the Tycos self-recording temperature apparatus under controlled conditions of room temperature and position and with uniform observation periods.

2. Calorimetric studies were made of heat production in the feet by means of the Stewart-Kegerreis calorimeter under carefully checked and controlled conditions with regard to rest and constant room temperature. The basis of calculations of heat transference is given in small calories, each minute for each square inch of surface area.

3. Clinical observations were made relative to the subjective symptoms, the color of the skin, the behavior of the sweat glands, and the blood-pressure readings. In the period following the operation there was considerable difficulty in controlling muscular movement. These estimations were made at the bedside and controlled as far as possible.

The article is summarized as follows:

Five cases of spastic paraplegia are reported in which bilateral lumbar sympathetic ramisection and ganglionectomy was performed. The second, third, and fourth lumbar ganglia with the sympathetic trunk were removed and the rami divided. During the postoperative period a marked increase in the skin temperature of the legs and feet was observed. Calorimetric studies with the foot calorimeter demonstrated a marked increase in heat production and heat radiation. In two cases there was complete absence of sweating in the legs. The vasomotor dilatation in the lower extremities which was indicated by the calorimetric studies was borne out by the clinical observations with respect to increased heat of the skin.

SURGERY OF THE CHEST

CHEST WALL AND BREAST

Holfelder: The Present Status of Irradiation of Cancer of the Breast (Der gegenwaertige Stand der Strahlenbehandlung des Brustkrebses). *Med. Klin.*, 1925, xxi, 213, 255.

The author traces the history of X-ray therapy from the beginning of irradiation of cancer of the breast through the period of irradiation of manifest cancer with "scattered doses" up to the present use of prophylactic irradiation after operation. The technique of postoperative irradiation has undergone the same changes as the irradiation of inoperable cancer of the breast.

Following a review of the advantages and disadvantages of the various methods, Holfelder recommends his "flanking technique" by which the powerful action of the rays is directed to the chest wall, the axilla, and the supraclavicular fossa while the skin is protected from overdosage and any noteworthy effect of the rays upon the deeper organs is prevented. Holfelder believes that by this technique he has solved the problem of the proper local distribution of the dosage.

In a discussion of the operative findings, the microscopic preparations, and the clinical results, Holfelder gives rules for the division of the roentgen-ray dosage with regard to time. The area of application should be as sharply outlined for a single irradiation with high dosage as for repeated small scattered doses.

It is emphasized that every operable cancer of the breast should be radically removed by surgery. Dependence upon irradiation should never prevent a radical operation when it is possible or lead the surgeon to perform a less thorough operation than is possible. STEGEMANN (Z).

Perry, A. C.: The After-Results of Operations for Malignant Disease of the Breast. *Brit. J. Surg.*, 1925, xiii, 39.

This article gives a detailed analysis of the postoperative results in 653 cases of malignancy of the breast and attempts to correlate them with the factors that may affect the prognosis. In cases not operated upon the prognosis is difficult to determine as the duration of the process before its detection and the degree of malignancy of different types of cancer are extremely variable. An absolute standard of cure is impossible to establish as recurrences are now known to appear after many years. Recurrences were found in 35 per cent of the cases examined by the author. The fact that in more than half of these they appeared first in the area of operation suggests that the primary operation failed to remove all of the involved tissue.

In 15 per cent, recurrences were found first in the supraclavicular glands. No patient with supraclavicular gland involvement survived longer than eighteen months. Early recurrences are more common in young patients and late ones in older patients, this fact confirming the belief that carcinoma is more malignant before than after the menopause. In cases of local recurrence the recurrence should be removed widely, together with the regional glands, and X-ray treatment should be given.

Twenty-eight per cent of the patients survived longer than seven years. The most favorable five-year period for operation from the standpoints of duration of life and delay of recurrence is between the ages of 50 and 54 years. The prognosis is less favorable in the cases of younger patients than in those of older patients, and more favorable in the absence of carcinomatous involvement of the axillary glands than in the presence of such involvement. It is possible that chronic inflammation of the axillary glands indicates increased resistance to cancer.

Medullary carcinoma is not as highly malignant as it is frequently stated to be. Carcinomatous hyperplasia should be regarded as definitely malignant and treated by radical operation. Papillary cystic and intracystic carcinomata are the least malignant, and intraductular carcinoma is only slightly more malignant. Recurrences may develop as late as fifteen years after operation. This almost precludes the possibility of establishing an absolute standard of cure in malignant disease of the breast.

The earlier the operation the more favorable the prognosis. All operations must be thorough. The advisability of removing the supraclavicular glands is suggested. Carcinomata having their origin in the lower inner quadrant of the breast do not appear to be any more dangerous than others. Operation certainly prolongs life, and in many hopeless cases renders the final stages of the disease more bearable.

LEO M. ZIMMERMAN, M.D.

TRACHEA, LUNGS, AND PLEURA

Gleeten, S. D.: Extrapleural Thoracoplasty. *California & West. Med.*, 1925, xxiii, 1011.

Thoracoplasty as a means of overcoming the rigidity of the chest wall was first brought to the attention of the surgical world in 1890, but because of its high mortality, the operation soon fell into disrepute. Later the use of local anæsthesia and the performance of the operation in two stages reduced the operative mortality to about 15 per cent.

The author believes that the indications for thoracoplasty are virtually the same as those for artificial

pneumothorax, viz.: (1) unilateral pulmonary tuberculosis that is not benefited by sanatorium or home care; (2) severe unilateral bronchiectasis and lung abscess which are not benefited by postural drainage or vaccines; and (3) the chronic unilateral post-influenzal condition resembling tuberculosis and requiring practically the same surgical treatment.

Artificial pneumothorax cannot be induced when there are pleural adhesions or when there is only a small pleural space, but should always be attempted before resort is had to thoracoplasty. A small pleural exudate or the presence of air, early unilateral renal tuberculosis, slight laryngeal tuberculosis, and bronchial fistulæ are not contra-indications to thoracoplasty; in fact, the only contra-indication is some other serious visceral disease.

Before operation in the author's cases the patient's general condition is improved as much as possible. After a preliminary hypodermic of morphine, a 1 per cent novocain solution is injected three or four fingerbreadths from, and parallel with, the spinous processes extending from the twelfth to the fourth ribs. Ether is absolutely contra-indicated. The use of about 400 c.cm. of novocain is necessary. Through a long linear incision each rib is resected close to the spine and a section from 8 to 11 cm. long is removed. Care is taken to avoid injuring the intercostal nerves and arteries. Each intercostal nerve is picked up and injected with a few drops of absolute alcohol. This decreases postoperative pain and makes further anæsthetization much easier if anterior section is contemplated. The wound is closed in layers with drainage.

The second stage is done after three or four weeks by the same procedure. As usually some difficulty is encountered in the removal of the first rib and in working under the scapula, it is sometimes necessary to use nitrous oxide and oxygen to supplement the novocain. After the resection the use of morphine is restricted as much as possible.

Improvement is usually rapid following the second stage, and may be favored by various measures which tend to compress the side operated upon. The use of compression apparatus may prevent the development of a scoliosis.

Case reports show that in 50 per cent of those operated upon the condition is either arrested or markedly improved. Operation should be performed before the patient becomes exhausted and before organs such as the heart and kidneys show degenerative changes from long-continued sepsis. The changes that occur in the collapsed lung are the approximation of the cavity or abscess walls, the collapse of air cells, and passive congestion. The lymph flow is increased so that there is better lymph drainage of the lung. The end-result is a gross fibrosis.

CYRIL J. GLASPEL, M.D.

Davies, H. M.: The Technique of Extrapleural Thoracoplasty. *Brit. J. Surg.*, 1925, xiii, 58.

The Sauerbruch type of extrapleural thoracoplasty is the type in most general use today. The preliminary treatment consists in rest in bed for ten days before the operation and the use of expectorants and posture to render the lungs as free from secretion as possible.

Local, general, or combined anæsthesia may be used for the operation, but the author prefers local anæsthesia supplemented by light chloroform narcosis. In addition, he injects the region of each nerve with 5 min. of absolute alcohol to prevent postoperative pain until the process has healed.

There is considerable difference of opinion as to the number of stages into which the operation should be divided. Some surgeons perform it in as many as four stages. Davies prefers to do it in one stage if possible. If the patient's general condition and color are satisfactory, if there is no respiratory difficulty on the operating table, if the sputum is not excessive, and if the disease is not acutely active, Davies begins the operation with a complete incision as for a one-stage procedure, but if there is any doubt as to the patient's ability to withstand complete rib resection, he begins it as for a two-stage operation and at the completion of the first stage performs the second stage only if the patient's general condition will permit it.

Almost invariably, resection of the first ten ribs is done, and usually is begun below. The amount of rib resected is unimportant, but it is essential that the resected portion extend back to the transverse processes of the vertebræ. The author describes his technique in detail.

After the operation the collapsed side should be supported for several months until ankylosis of the cut ends of bone occurs. Rest in bed for at least three weeks is essential. The patient must be kept under a sanatorium régime.

The symptoms frequently cease suddenly after the operation, but sometimes the improvement is gradual. Occasionally there is pain in the arm and shoulder for a few days from the drag on the brachial plexus. Usually there is very little postoperative shock or discomfort. Motion in the shoulder is not impaired, and the deformity is comparatively slight.

LEO M. ZIMMERMAN, M.D.

Graham, E. A.: The Rôle of Surgery in the Treatment of Pulmonary Suppuration. *J. Am. M. Ass.*, 1925, lxxxv, 181.

The author describes the indications and technique for his procedure for chronic pulmonary suppuration which he calls "cautery pneumectomy." This method combines all of the known effective principles in the treatment of chronic lung suppuration, namely, drainage, compression, and extirpation of the diseased tissue.

Compression of the affected portion of lung is produced more effectively and more precisely by this method than by pneumothorax or thoracoplasty because the degree of pressure is regulated by the amount of packing in the wound. As the diseased lobe does not need to be mobilized, there is no exposure of the mediastinal pleura or pericardium

to infection such as occurs in ordinary lobectomy; and suppurative mediastinitis, the factor chiefly responsible for the mortality of lobectomy, is absent. When pneumectomy is effected by means of the cautery an effort is made to remain inside the lung tissue.

The author considers the method applicable not only to cases of unilateral chronic lung suppuration but also to the hitherto practically hopeless bilateral cases. A case of the latter type in which it was successful is reported. Of thirty-one other cases, a cure was obtained in 55 per cent. A total of 74 per cent of the patients are known to be either free from symptoms or benefited. There were seven deaths, a mortality of 22 per cent. The one death which could be attributed to the operation was due to hæmorrhage. Four deaths were due to a cerebral complication, probably embolism.

SHIRLEY C. LYONS, M.D.

Stern, S.: The Treatment of Lung and Mediastinal Neoplasms by High-Voltage Roentgen Therapy. *Am. J. Roentgenol.*, 1925, xiv, 8.

Stern reports five cases of intrathoracic malignancy. One was a case of metastatic carcinoma secondary to carcinoma of the thyroid gland, and another probably belonged to the same group. The third was a case of thymoma, and the fourth and fifth were cases of primary neoplasms of the lung or mediastinum.

One case terminated fatally about one month after the beginning of treatment. In the others, marked improvement is evident, but the interval since the beginning of treatment has been only fourteen months in one case and about a year in the others. The patients are in good general health; the final examination of three of them was negative.

The author believes that radiation treatment should be given a trial in every case of pulmonary and mediastinal malignancy.

CHARLES H. HEACOCK, M.D.

ŒSOPHAGUS AND MEDIASTINUM

Mulherin, W. A., Holmes, L. P., and Harrell, H. P.: The Thymus in Infancy, Especially in the Newly Born (Preliminary Report). *South. M. J.*, 1925, xviii, 494.

The authors studied the thymus in 111 infants, eighty of whom were in the first week of life and thirty-one between 2 weeks and 2 years of age. Roentgenograms were made with the infants in the supine position, the occiput resting upon the table and the ray directed through the sternum. As a working average between the normal and the enlarged thymus, a lateral measurement of 3 cm. in the second intercostal space was selected. This was found preferable to other measurements.

Nine infants of the series showed active clinical manifestations of thymus enlargement such as cough, dyspnœa, and cyanosis. In all of these the transverse measurement was 3 cm. or more.

A clinical diagnosis of enlarged thymus should be made when the triad of enlarged shadow, positive symptoms, and improvement after X-ray treatment is present. The only exception is the thymus which is enlarged in its anteroposterior diameter. None of this type was found. When the thymus measures more than 3 cm., symptoms may be manifested after physical stress or disease.

The authors do not agree that hyperthymization is the cause of the symptoms. The assumption that an enlarged thymus is evidence of status lymphaticus has been proved incorrect. The most logical explanation of the production of symptoms is that which attributes them to mechanical compression. Tracheostenosis has been repeatedly demonstrated with enlarged thymus. The authors were unable to substantiate the contention of Gerstenberger that the thymic shadow produced by forced expiration can be made to disappear during inspiration as they found little variation in relation to the position of the diaphragm.

WILLIAM J. PICKETT, M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Talmann, I. M.: Internal Incarceration of the Intestines in Mesenteric Clefts (Ueber innere Darmeinklemmungen in Mesenterialspalten). *Arch. f. klin. Chir.*, 1925, CXXXV, 776.

The author reports a case of incarceration of the sigmoid colon from the sigmoid flexure to the beginning of the rectum in a mesenteric fold of the ileum in such a manner that it lay to the right of the lumbar spine. The intestine was dilated to the thickness of an arm and was covered by a fatty exudate. A diffuse purulent peritonitis was present. As the patient was not admitted to the hospital until the third day after the onset of complete ileus, general peritonitis had developed by the time he was first seen by the author, and as at laparotomy there were signs of cardiac weakness resection was not attempted.

The causes of mesenteric clefts include congenital malformations, which usually are multiple, and inflammation occurring during fetal life. The responsibility of inflammation is indicated by the fact that the most common site of mesenteric clefts is near the lower ileum in the region of the appendix.

ROSENBURG (Z).

GASTRO-INTESTINAL TRACT

Goldie, W.: History Taking of Chronic Gastro-Intestinal Disease. *J. Iowa State M. Soc.*, 1925, XV, 346.

The author reviews the embryological development, innervation, and physiology of the stomach. While it is generally true that stimuli traveling the bulbosacral route excite activity in the general coat and cause relaxation of the sphincters; and that the opposite occurs when stimuli travel the thoracic lumbar outflow, there is evidence that stimuli traveling along either or both may produce contraction of the pylorus and merely modify the character of the activity and relaxation in the rest of the musculature.

The muscle cell has the power to initiate rhythmic active contraction to transmit stimuli to the adjacent cells, to develop continuous stationary contraction (tonic or tetanic), and actively to relax.

While these properties are under a certain amount of external control by efferent stimuli along the two opposed routes, the principal control of the activities and correlations seems to be a modification of these inherent properties and the action of local neurons, local stimuli, and local reflexes.

Delivery of food from the stomach to the duodenum requires forces produced by gravity, tonic contraction of the stomach wall, and the propulsive action of peristaltic waves. The regulation of the size of the pylorus is as yet not understood, but it is known that acid and alkali reactions have little or nothing to do with it. It appears that delivery is made according to the capability of the tract beyond the pylorus to pass on the contents, and it is to be expected that difficulties in the tract beyond would influence the activities of the stomach to receive, to deliver, or to reject.

The inquiry into the course of an "indigestion" should be directed particularly to the determination of: (1) the duration of the attack or attacks, (2) the length of the intervals, (3) whether the symptoms at the onset were the same as those occurring later in the attack, (4) whether the recent attack had the same characteristics as the first and all other attacks, (5) whether the intervals were formerly and are now absolutely free from abnormal sensations, (6) whether anything provokes or exaggerates an attack, and (7) whether any change in the routine or the functional activities eases or cuts short an attack.

An indigestion which begins at about middle life or in which the character of the attacks has changed must be considered due to a malignant growth unless the absence of malignancy can be proved.

A continued indigestion characterized by absolute irregularity of the attacks and intervals must be due to a lesion lying outside the main upper tract. It is important, however, to check such a history by inquiring whether the irregularity is due to changes in routine or to the taking of palliatives.

An indigestion with regularity in the duration and interval of the attacks but with onset of symptoms of a character different from that of the main course of each attack or of most of the attacks indicates that the lesion lies outside the main upper tract.

An indigestion characterized by regularity in the duration and interval of the attacks and with absolute freedom from discomfort in the intervals indicates a local lesion in the main upper tract. If there is not absolute freedom in the interval, close inquiry must be made as to the timing of the discomfort that is felt in the intervals.

The occurrence of changes in the attacks other than variation in the severity of the symptoms indicates that a new factor is acting. Such a factor may be a narrowing of the lumen, extension of the damage through the wall to the peritoneum and adjacent structures, or the onset of malignancy.

The indigestion that begins with worry or anxiety and ceases as soon as the cause is removed has no organic basis, but if it continues after the removal of the cause, there is a secondary and probably minor cause acting reflexly, such as functional colonic stasis.

Indigestion that is eased by bicarbonate of soda without consequent belching is due to a local lesion or local spasm in the stomach or duodenum. If relief is obtained only by belching, there is either no local lesion in the stomach or partial obstruction has been added to the local lesion.

Indigestion in relation to one special article of diet is probably of anaphylactic origin.

Attention is called to the extreme variableness of the symptoms of gastric ulcer as compared with those of duodenal ulcer. The most common organic cause of indigestion is chronic gall-bladder disease.

MERLE R. HOON, M.D.

Bolling, R. W.: Congenital Hypertrophic Pyloric Stenosis: A Review of 454 Cases in Which the Fredet-Rammstedt Operation Was Performed. *J. Am. M. Ass.*, 1925, lxxxv, 20.

Bolling reviews a series of 454 cases in which the Fredet-Rammstedt operation was performed for hypertrophic pyloric stenosis in babies. The operative procedure is curative and its results are permanent. A fatal outcome in such cases is due largely to delay in the diagnosis and treatment. Operation should be done in all but the mild cases. In the series reviewed there were sixty-seven deaths, a mortality of about 15 per cent. The most frequent cases of death are postoperative shock, bronchial pneumonia, and hæmorrhage. In six cases the operation was followed by peritonitis.

The etiological factor in congenital hypertrophic stenosis of the pylorus is a congenital hyperplasia of the circular muscle fibers. The diagnosis is readily made from the presence of a palpable pyloric tumor and gastric peristalsis. Bolling considers the tumor a most important sign. The projectile vomiting and weight loss are terminal signs of starvation.

In the author's cases a preliminary hypodermoclysis of a 3 per cent glucose solution is administered twelve hours before operation. In the cases of dehydrated infants, body heat is maintained by frequent hypodermoclysis and from one to three blood transfusions. Operation is performed under ether anæsthesia unless the patient is a poor risk, in which case local anæsthesia is employed. A right rectus incision is made, the pyloric end of the stomach and the tumor are delivered through the wound, an incision is made through the peritoneum and superficial muscle fibers parallel with the lumen of the pylorus, and the muscle fibers are separated by blunt dissection so that the mucous layer protrudes slightly through the wound. The pylorus is then returned to the abdomen. No omental covering is done.

JOHN W. NUZUM, M.D.

Davison, W. C.: Pyloric Stenosis of Infants: A Statistical Analysis of Sixty Cases. *Bull. Johns Hopkins Hosp.*, Balt., 1925, xxxvii, 75.

The author reviews sixty cases of pyloric stenosis in infants, thirty-two of which were treated medically and twenty-eight surgically. The two groups are compared with regard to the age, sex, and color of the infants; the time of onset of the condition; the type and severity of the symptoms; the presence of the four cardinal symptoms—visible gastric peristalsis, projectile vomiting, a palpable tumor of the pylorus, and constipation; and the mortality.

There were twice as many white males as white females, but among the colored infants the ratio of the sexes was about even. The mortality was higher among the males than the females and among the white infants than the colored infants. It was highest also among those in which the onset of the condition was sudden, among those losing a high percentage of their birth weight, among those which were constipated, among those which weighed less than 7 lbs. at birth or at the time of their admission to the hospital, and among those treated surgically.

In 75 per cent of the cases the symptoms began during the first three weeks of life. Nearly half of the infants were first-born children.

The fact that the death rate was greater in the cases treated surgically than in those treated medically proves that operation should not always be performed as soon as the diagnosis is made. Immediate surgical treatment should be given, however, in the cases of all patients who are in such poor condition on their admission to the hospital that delay would be fatal. Operation is indicated also when medical therapy fails to cause improvement. In the cases of infants who are not in a critical condition, medical treatment should be tried before surgical measures.

MARCUS H. HOBART, M.D.

Blaine, E. S.: Simple Penetrating Ulcer of the Greater Curvature of the Stomach. *Am. J. Roentgenol.*, 1925, xiv, 20.

Blane reports three cases of simple penetrating ulcer of the greater curvature of the stomach that were detected by means of the roentgen ray. Two of the ulcers were on the proximal third of the curvature and one was at the juncture of the proximal and middle thirds. In one case the roentgenological findings were confirmed at operation.

The roentgen-ray signs of ulcer on the greater curvature are the same as those of ulcer on the lesser curvature but are less readily elicited because the depth of the gastric rugæ prevents over-distention of the proximal portion of the stomach, the greater curvature does not have as smooth a contour as the lesser curvature, and the shadow of the duodenojejunal juncture is projected over the greater curvature at or about the juncture of its upper and middle thirds. Many roentgenologists of large experience have never seen an ulcer on the greater curvature. As the comparative rarity of the lesion is recognized, this portion of the stomach often receives little more than passing notice.

CHARLES H. HEACOCK, M.D.

Rendleman, W. H.: The Diagnosis and Medical Treatment of Gastric and Duodenal Ulcer. *J. Iowa State M. Soc.*, 1925, xv, 363.

In the diagnosis of gastric and duodenal ulcer the history and the X-ray examination give the most

reliable information. The diagnostician should be able to make his own fluoroscopic examinations or should be present at the examination. The fluoroscopic examination should be supplemented by a few plates.

The most common complant is pain. This has a characteristic periodicity, recurring punctually from one to four hours after one or more meals a day. It is a gnawing and burning pain located in the epigastrium but occasionally referred to the back near the spine and below the left scapula. It becomes more severe after a heavy meal and is relieved by food and alkalies. It never begins immediately after meals and never lasts after the time the stomach should be empty unless there is retention from pyloric obstruction.

In gastric ulcer the cycle is food, comfort, pain disappearing before the next meal, comfort. In duodenal ulcer the cycle is food, comfort, pain lasting until the next meal. The pain which awakens a patient regularly at a certain time of night is characteristic of duodenal ulcer.

The diagnosis of duodenal ulcer may be made from the history alone. That of gastric ulcer is more difficult. Gastric distress is probably due to muscular contraction, gastric tension, and especially the action of free hydrochloric acid on the nerve endings. Local tenderness may be present. Heartburn, sour eructations, and belching are common. Vomiting may occur at the height of the distress, especially when there is retention from pylorospasm or organic obstruction, and gives immediate relief. Hæmatemesis is of considerable significance. Blood in the stools may first call attention to the ulcer. Perforation may occur without previous symptoms.

In atypical cases the X-ray is of great value in differentiating between the gall bladder, appendix, and stomach. The direct X-ray signs are a crater, an hour-glass shape of the stomach, and deformity of the cap. The indirect signs are incisura, a six-hour residue, hyperperistalsis, absence of filling of the cap, and localized tenderness.

Analysis of the gastric contents determines mainly the motility and emptying time. There is usually high acidity, and frequently sarcinæ are found. The free hydrochloric acid is of interest only to rule out cancer. The author does not make a routine gastric analysis in all cases of gastric conditions.

Examination of the stools shows when bleeding has stopped, which is usually promptly after the beginning of treatment. The therapeutic test is of great diagnostic value because diet and alkali give prompt relief unless there are complications such as perigastric adhesions, pyloric obstruction, or malignancy.

For an accurate diagnosis it is necessary to determine also whether complications are present. Pyloric obstruction is indicated by the vomiting of food eaten the day before or of large quantities of gastric juice; a food residue after seven hours; a six-hour barium-meal residue; and visible peristaltic waves. Acute perforation, the most important complication, is evidenced by sudden, acute, excruciating pain in the upper abdomen which doubles the patient up and produces muscle rigidity.

Chronic perforation, hour-glass stomach, and perigastric adhesions are shown by the X-ray. Acute hæmorrhage causes sudden anæmia, pallor, weakness, and air hunger with hæmatemesis or melæna. Secondary carcinoma is suggested by the X-ray picture of a large crater, the continuous presence of blood in the stools, and distress which is not relieved by medical treatment. A palpable mass is usually cancer or chronic perforation. The danger of carcinomatous degeneration of an ulcer has been greatly exaggerated. Most cases of cancer gave no ulcer history.

Ulcer must be differentiated from cholecystitis, chronic appendicitis, hyperchlorhydria, and cancer. In patients over 50 years of age the author sees more ulcers than cancers. The close relationship of cholecystitis, appendicitis, and ulcer is too frequent to be a coincidence.

Rendleman employs a modified Sippy treatment. All patients operated upon should be treated postoperatively for weeks or months. Gastro-enterostomy must be supplemented by reduction and neutralization of the gastric acidity. Physical and mental rest is essential. Most cases require rest in bed for from two to four weeks. This reduces the food requirement to the minimum and rests the stomach. Mental rest may sometimes be obtained better by ambulatory treatment. Diet and alkalies should be continued for a year or longer. In the beginning of treatment it is important to aspirate the stomach occasionally to determine whether the acid is neutralized.

Most cases in which medical treatment has failed are cases in which such treatment was not thorough. Medical treatment will usually relieve the obstructive type of ulcer due to spasm or inflammatory exudate in from two to three weeks. Lavage of the stomach at evening removes food and gastric juice accumulations and gives the stomach rest. Acute hæmorrhage is controlled by absolute rest, the administration of morphine, and fasting. Alkali neutralization of the acid prevents digestion of the clot at the site of the hæmorrhage. Foci of infection must be eliminated, but the removal of a large number of teeth will prevent the thorough mastication of food.

From the medical viewpoint the author considers that operation is indicated by suspected cancer, complete pyloric obstruction, incomplete obstruction which has not yielded to several weeks of medical care, repeated or continuous hæmorrhage as determined by examination of the stools, acute and chronic perforations, and any ulcer that does not yield to thorough medical treatment. The place of surgery in the treatment of uncomplicated ulcer has not yet been definitely determined. This is evident from the constant change in methods used and the facts that many gastro-enterostomies must be undone, the symptoms may recur and a gastro-

jejunal ulcer may form after operation, and the operative mortality, even in cases treated by the most skilled surgeons, ranges from 2 to 8 per cent.

In the author's opinion, gastric and duodenal ulcer will probably remain borderline lesions.

Many acute ulcers heal and leave no symptoms or scar. The ulcer is considered healed if the patient remains without symptoms or bleeding for several years, the fluoroscope shows normal stomach outlines and the passage of peristaltic waves through the ulcer area, and there is no local tenderness.

WALTER C. BURKET, M.D.

Dakin, C. E.: The Etiology and Surgical Treatment of Ulcer of the Stomach and Duodenum. *J. Iowa State M. Soc.*, 1925, xv, 367.

In ulcer there may be excessive, normal, or diminished acidity or normal or decreased alkalinity. Ulcers are prone to occur at sites normally alkaline which are exposed to acid fluids. Gastric ulcers are associated with lessened acidity more frequently than duodenal ulcers. Acute ulcers are produced experimentally by local trauma from violence, the action of caustics, artificial obstruction of the intestinal current, and the intravascular injection of mercury, arsenic, or bacteria. Toxæmia, which induces hæmorrhage in the stomach wall, often causes acute ulceration.

When streptococci from the tonsils of a patient with ulcer are injected into animals they cause ulcer in over 70 per cent of the experiments. In the majority of his experimental animals in which he injected streptococci from the infected tooth of a patient with ulcer, Rosenow obtained ulcers at the sites of infarction of the blood vessels. Another proof of the relation of infection to ulcer is the frequent association of ulcer with infections of the gall bladder and appendix which we have come to regard as definitely of focal origin.

Mann and Williamson produced chronic and subacute ulcers in the intestinal mucosa from which the secretions normally neutralizing the gastric juice were diverted. From the work of Rosenow, Mann, and Williamson the author concludes that ulcer is caused by the infarction of vessels blocked by streptococci with a special affinity for the stomach wall in an area deprived of resistance by a decrease of the normal alkalinity. In severe chronic gastric ulcer there is danger of malignant growth in the ulcer base.

Mild acute ulcers tend to heal spontaneously and respond well to medical care. More virulent ulcers with frequent early hæmorrhage or perforation gradually become chronic and require radical surgery. A chronic ulcer with a distinct crater visible in the roentgenogram or causing food retention or adhesions to neighboring organs cannot be controlled by medical therapy.

Prophylaxis consists in building up immunity and removing foci of infection, especially diseased teeth and tonsils containing specific streptococci.

Surgical treatment includes measures to render the secretion normal; drainage of obstructed viscera to relieve retention of food; the removal of infected tissue; the relief of hyperperistalsis and its associated pain; the control of bleeding points; the closure of ulcer perforations; and the prevention of recurrence of malignant growth.

No one method is applicable to all cases. Gastrojejunostomy alone or combined with cautery destruction or excision of the duodenal ulcer effects a cure in 95 per cent of the cases. Jejunal ulcer, a complication in from 1 to 4 per cent, is extremely resistant to medical treatment and requires excision and re-establishment of the normal relations of the stomach and bowel with removal of any remnant of the original lesion. Resection of the duodenal ulcer alone should be limited to cases in which the duodenum can be mobilized and the resulting scar will not cause constriction or obstruction. Cases of perforation of a duodenal ulcer may be treated by gastro-enterostomy after cauterization and suture of the ulcer if the operation is done early.

In cases of small gastric ulcers cauterization or excision of the lesion with gastro-enterostomy gives excellent results. Large ulcers require partial gastrectomy of the sleeve type or with pyloric resection. Because of the danger of malignancy there is a growing tendency to extend gastrectomy to all cases although there is no definite statistical proof that cancer occurs more frequently after excision of the ulcer and gastro-enterostomy than after gastrectomy. Gastro-enterostomy with or without excision of the ulcer followed by dietetic measures and medical care for an extended period is preferred by the author to the exclusive use of Finsterer's partial gastrectomy for the reduction of hyperacidity by removal of the hormone-forming portion of the stomach. Jejunal ulcer occurs no more frequently after gastro-enterostomy than recurrence of the original gastric ulcer.

Medical therapy alone is prolonged, expensive, and impractical for the ordinary worker. Properly planned surgery decreases the time necessary for a cure and makes the medical care of the case easier and more effective. WALTER C. BURKET, M.D.

Hellmer, H.: A Study of the Gastro-Intestinal Mucosa After Gastro-Enterostomy (Étude sur la muqueuse gastro-intestinale après gastro-entéro-anastomose). *Acta radiol.*, 1925, iv, 32.

The author made roentgen examinations of thirty-five patients on whom resection with gastro-enterostomy or gastro-enterostomy alone had been performed and in addition studied five autopsy specimens obtained from such subjects. Detailed descriptions of eleven cases are illustrated with drawings of the specimens or with roentgenograms. These show that in the neighborhood of the anastomosis the folds of mucous membrane of the stomach and small intestine have undergone marked rearrangement. The folds of the stomach converge toward the anastomosis, lie closer together, and are higher than is usual at the corresponding site in a normal stomach. On the intestinal side,

the folds show a tendency to collect in greater numbers near the anastomosis than at a distance from it.

On the basis of Forssell's theory that the folds of mucous membrane regulate the passage of food through the alimentary tract by active movements, the author suggests the possibility that the demonstrated mucous membrane formations on either side of the anastomosis are produced by active movements of the mucous membrane.

He suggests also that his findings may justify the assumption that a severe spastic condition of the muscularis mucosæ may sometimes obstruct passage through the anastomosis.

Balfour, D. C.: The Management of Lesions of the Stomach and Duodenum. *Surg. Clin. N. Am.*, 1925, v, 673.

The author believes that more active detection and interpretation of the signs of disease, better surgical judgment, and quicker recognition and treatment of complications have combined with riper experience to improve the results of the surgical treatment of diseases of the stomach and duodenum. He cites five cases in support of his belief.

The first was a case of gastric polyposis and gastric ulcer in which the roentgenological diagnosis was a lesion at the outlet of the stomach. This disease is uncommon and must not be confused with the malignant papillomatous masses which are occasionally encountered in the stomach.

The second case illustrates the unsatisfactory result of Kocher's gastroduodenostomy. This operation had been performed three years before for a deforming ulcer near the pylorus. When the author operated he did not discover the stoma until he was about to perform a partial gastrectomy. The cause of the persistent symptoms and the futility of the original operation as it was performed are discussed.

In the discussion of the third case Balfour's preference for partial exclusion of the stomach instead of simple gastro-enterostomy for bleeding duodenal ulcer is explained. Devine's method was followed. In a number of cases the author has had excellent immediate results, but he is not yet able to foretell the likelihood of the formation of a jejunal ulcer at the site of the anastomosis.

In the fourth case there was a perforating ulcer on the posterior wall about 10 cm. from the pylorus with so much thickening of the stomach and surrounding tissues that partial gastrectomy was inadvisable. At the first operation the ulcer was destroyed by the cautery and a gastro-enterostomy was performed in the hope that the lesion would heal. After eight months of complete relief the symptoms recurred. At the second operation the ulcer was excised and a thick-walled, tubular stomach was left. Convalescence was marked by intractable vomiting and eventually by a high degree of toxæmia confirmed by chemical studies of the blood. McVicar undertook treatment with physiological sodium chloride solution and 10 per cent glucose. The blood urea then fell from 292 to 21 mgm. in a few days, and the chlorides increased from 490 to 620, while the carbon-dioxide combining power dropped from 62 to 43. Just at this point a patch of pneumonia was discovered, and the blood chlorides rose to 735.

In the fifth case seven operations had been performed without relief of vomiting of bile which had persisted since the original gastro-enterostomy. The author disconnected the anastomosis and performed partial gastrectomy with ante-colic end-to-side anastomosis. The patient was relieved and is expected to recover satisfactory gastric function.

Westman, A.: A Case of Hernia Incarcerated in the Foramen of Winslow. *Acta chirurg. Scand.*, 1925, lix, 181.

The author reports a case in which a loop of ileum was found incarcerated in the foramen of Winslow and resection of the incarcerated portion was necessitated by necrosis. After the operation the function of the intestine was normal but the patient died from a pulmonary complication.

Hartwell, J. A., and Dudley, G. S.: The Value of Gastro-Enterostomy in the Treatment of Duodenal Ulcer. *J. Iowa State M. Soc.*, 1925, xv, 337.

Much contradictory evidence has been offered concerning the value of the various methods of treating duodenal ulcer. For thirty-five years gastro-enterostomy has been in favor in spite of the fact that it may be associated with complications such as vicious circle, intestinal obstruction, and hæmorrhage. It was discovered that when obstructing cicatrices resulted from untreated pyloric ulcer this operation gave excellent results; whenever a secondary operation was performed, the callous mass was found to have disappeared. Since the indications for gastro-enterostomy have been more definitely established and the technique of the operation has been improved, the results have been more satisfactory.

Requisites for a satisfactory gastro-enterostomy are: (1) a stoma 2 in. in length in the posterior wall of the stomach, in or near the antrum and as near as possible to the greater curvature; (2) suturing of the mesocolon to prevent herniation; (3) the use of absorbable suture material throughout; (4) a short jejunal loop; (5) free suspension of the efferent limb.

Points still disputed are the proper direction of the gastric incision—whether it should be horizontal, vertical, or oblique; the advisability of the use of retention clamps, whether the jejunal and gastric mucosa should be sutured as separate layers, and whether pyloric exclusion should be done. In the authors' opinion, the results are not improved by pyloric exclusion.

As a result of the observation that many acute perforated ulcers are healed by simple suture, deliberate destruction of the ulcer by excision, cauterization, or inversion has been advised. Pylo-

roplasty and gastroduodenostomy have been advocated by Finney, Flint, Horsley, and others.

Morehead gave three causes for failure of gastro-enterostomy to give relief: (1) unhealed ulcers, (2) marginal ulcers, and (3) forcible contractions in a dilated pyloric pouch when the stoma is placed too far from the pylorus.

Hort expresses the belief that all symptoms subsequent to operation may be prevented by taking care of foci of infection in the tonsils, teeth, etc.

Moynihan said: "The operation of gastro-enterostomy in appropriate cases by competent operators is probably the most successful of all surgical procedures of equal magnitude." He attributes the disappointments and failures to many factors: (1) the performance of the operation for disorders other than gastric or duodenal ulcer; (2) failure to remove other foci of infection within the abdomen; (3) failure to deal with the ulcer itself; (4) defects in the technique resulting in a long loop and in a short loop with its efferent arm blocked by a kink or adhesions, the formation of too small an opening or an opening in an improper position, and the use of non-absorbable suture material; (5) recurrence of the adhesions on the raw surface left after separation of the jejunum from the surface of the mesocolon; (6) rotation of the jejunum on its long axis; (7) hernia, and (8) late complications such as jejunal ulcer and cancer.

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MERLE R. HOON, M.D.

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In seven of twelve cases in which a gastric analysis was made, free hydrochloric acid was present in subnormal amount and in five there was achlorhydria. Gross gastric retention was present in all except one case. In the cases in which the carcinoma was in the infra-ampullary portion of the duodenum there was excess fluid containing bile and pancreatic juice. A dilated stomach with considerable barium residue and without a demonstrable gastric lesion was the usual roentgen-ray finding. In two cases, gastric and duodenal dilatation and barium retention made possible an exact anatomical diagnosis. The toxæmia of high intestinal obstruction is a serious complication and invariably present in these cases. The authors discuss the diagnosis and treatment. After proper pre-operative treatment a palliative gastro-enterostomy is a justifiable procedure.

Conditions that may give rise to difficulty in the differential diagnosis are malignant and benign pyloric obstruction; carcinoma of the head of the pancreas or the gall bladder with involvement of the duodenum; carcinoma of the ampulla or terminal portion of the common duct; and benign duodenal obstruction, the result of bands when there are supraduodenal vessels of Wilkie, inflammatory masses, peritoneal tuberculosis, and extensive postoperative adhesions.

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Rothschild, N. S.: Diverticula of the Jejunum. *Ann. Surg.*, 1925, lxxxii, 250.

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the folds show a tendency to collect in greater numbers near the anastomosis than at a distance from it.

On the basis of Forssell's theory that the folds of mucous membrane regulate the passage of food through the alimentary tract by active movements, the author suggests the possibility that the demonstrated mucous membrane formations on either side of the anastomosis are produced by active movements of the mucous membrane.

He suggests also that his findings may justify the assumption that a severe spastic condition of the muscularis mucosæ may sometimes obstruct passage through the anastomosis.

Balfour, D. C.: The Management of Lesions of the Stomach and Duodenum. *Surg. Clin. N. Am.*, 1925, v, 673.

The author believes that more active detection and interpretation of the signs of disease, better surgical judgment, and quicker recognition and treatment of complications have combined with riper experience to improve the results of the surgical treatment of diseases of the stomach and duodenum. He cites five cases in support of his belief.

The first was a case of gastric polyposis and gastric ulcer in which the roentgenological diagnosis was a lesion at the outlet of the stomach. This disease is uncommon and must not be confused with the malignant papillomatous masses which are occasionally encountered in the stomach.

The second case illustrates the unsatisfactory result of Kocher's gastroduodenostomy. This operation had been performed three years before for a deforming ulcer near the pylorus. When the author operated he did not discover the stoma until he was about to perform a partial gastrectomy. The cause of the persistent symptoms and the futility of the original operation as it was performed are discussed.

In the discussion of the third case Balfour's preference for partial exclusion of the stomach instead of simple gastro-enterostomy for bleeding duodenal ulcer is explained. Devine's method was followed. In a number of cases the author has had excellent immediate results, but he is not yet able to foretell the likelihood of the formation of a jejunal ulcer at the site of the anastomosis.

In the fourth case there was a perforating ulcer on the posterior wall about 10 cm. from the pylorus with so much thickening of the stomach and surrounding tissues that partial gastrectomy was inadvisable. At the first operation the ulcer was destroyed by the cautery and a gastro-enterostomy was performed in the hope that the lesion would heal. After eight months of complete relief the symptoms recurred. At the second operation the ulcer was excised and a thick-walled, tubular stomach was left. Convalescence was marked by intractable vomiting and eventually by a high degree of toxæmia confirmed by chemical studies of the blood. McVicar undertook treatment with physiological sodium chloride solution and 10 per cent glucose. The blood urea then fell from 292 to 21 mgm. in a few days, and the chlorides increased from 490 to 620, while the carbon-dioxide combining power dropped from 62 to 43. Just at this point a patch of pneumonia was discovered, and the blood chlorides rose to 735.

In the fifth case seven operations had been performed without relief of vomiting of bile which had persisted since the original gastro-enterostomy. The author disconnected the anastomosis and performed partial gastrectomy with ante-colic end-to-side anastomosis. The patient was relieved and is expected to recover satisfactory gastric function.

Westman, A.: A Case of Hernia Incarcerated in the Foramen of Winslow. *Acta chirurg. Scand.*, 1925, lix, 181.

The author reports a case in which a loop of ileum was found incarcerated in the foramen of Winslow and resection of the incarcerated portion was necessitated by necrosis. After the operation the function of the intestine was normal but the patient died from a pulmonary complication.

Hartwell, J. A., and Dudley, G. S.: The Value of Gastro-Enterostomy in the Treatment of Duodenal Ulcer. *J. Iowa State M. Soc.*, 1925, xv, 337.

Much contradictory evidence has been offered concerning the value of the various methods of treating duodenal ulcer. For thirty-five years gastro-enterostomy has been in favor in spite of the fact that it may be associated with complications such as vicious circle, intestinal obstruction, and hæmorrhage. It was discovered that when obstructing cicatrices resulted from untreated pyloric ulcer this operation gave excellent results; whenever a secondary operation was performed, the callous mass was found to have disappeared. Since the indications for gastro-enterostomy have been more definitely established and the technique of the operation has been improved, the results have been more satisfactory.

Requisites for a satisfactory gastro-enterostomy are: (1) a stoma 2 in. in length in the posterior wall of the stomach, in or near the antrum and as near as possible to the greater curvature; (2) suturing of the mesocolon to prevent herniation; (3) the use of absorbable suture material throughout; (4) a short jejunal loop; (5) free suspension of the efferent limb.

Points still disputed are the proper direction of the gastric incision—whether it should be horizontal, vertical, or oblique; the advisability of the use of retention clamps, whether the jejunal and gastric mucosa should be sutured as separate layers, and whether pyloric exclusion should be done. In the authors' opinion, the results are not improved by pyloric exclusion.

As a result of the observation that many acute perforated ulcers are healed by simple suture, deliberate destruction of the ulcer by excision, cauterization, or inversion has been advised. Pylo-

roplasty and gastroduodenostomy have been advocated by Finney, Flint, Horsley, and others.

Morehead gave three causes for failure of gastro-enterostomy to give relief: (1) unhealed ulcers, (2) marginal ulcers, and (3) forcible contractions in a dilated pyloric pouch when the stoma is placed too far from the pylorus.

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The author reviews the thirty-three cases reported in the literature. In twenty-one, the condition was discovered at autopsy, and in ten at operation.

There are two types of diverticula—the false and the true. The false diverticula have no muscular layers.

Etiological factors are traction on the intestine by the mesentery and adhesions; increased intra-intestinal pressure; venous congestion causing separation of the muscles of the intestine with subsequent herniation of the mucosa; fatty degeneration of the tunica muscularis; and diminished resistance of the connective tissue around the veins.

Jejunal diverticula occur most frequently in late life and may be single or multiple. They range in size from that of a pea to that of an apple. The symptoms may be those of acute or chronic intestinal obstruction.

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The author reports two cases of peptic ulcer of the jejunum following gastro-enterostomy in children, one that of a girl 14 years of age who had had symptoms since her tenth year, and the other that of a girl 18 years of age who had had symptoms since her fourteenth year.

Our present knowledge of the etiology and pathogenesis of ulcers in children is just as imperfect as our knowledge of ulcers in adults. Michaëlsson states that chronic duodenal ulcers and peptic ulcer of the jejunum following gastro-enterostomy have been found even in infants. In reply to Theile's claim that no proved case of chronic simple ulcer in a child under 5 years of age has been reported in the literature, Michaëlsson reports a case in which a large chronic gastric ulcer was discovered in a girl 2 years of age. Part of this ulcer was cicatrizing while another part had perforated.

Of 911 patients with ulcer of the gastro-intestinal tract who were examined with the roentgen ray at the Maria Hospital of Stockholm in the period from 1919 to 1924, fourteen were under 15 years of age. Of these fourteen, eleven were girls. A duodenal ulcer was found in six, a juxtapyloric ulcer in three, and a gastric ulcer in two. The three boys had duodenal ulcers. In 3.5 per cent of 450 cases of gastroduodenal ulcer which were operated upon by Hedlund, and in 5 per cent of 192 cases treated at the Umea Hospital in the period from 1920 to 1923, the symptoms dated back to infancy.

Dixon, C. F., Burns, J. G., and Giffin, H. Z.: Pernicious Anæmia Following Ileostomy. *J. Am. M. Ass.*, 1925, lxxxv, 17.

The authors discuss the possibility of an intestinal origin of pernicious anæmia. As they believe that impairment of the motor function of the intestinal tract may be a factor, they performed an ileostomy in six cases. The first patient was operated upon January 30, 1924. One patient died four weeks after the operation from cerebral hæmorrhage, but his blood count had returned to normal. In the case of another patient, who died from acute respiratory infection, the blood count had slowly improved. Two of the patients have had a return of the anæmia, but the remaining two are doing well. One has been free from anæmia for a year and has had no medical treatment.

In every case the ileostomy was followed by marked improvement in the appetite, a marked reduction in the paræsthesia, and disappearance of the icteroid tint. The urobilinogen disappeared from the urine and the ileac contents.

In conclusion the authors state ileostomy cannot as yet be advocated as a general therapeutic measure, but is justifiable in certain cases. It alters some of the features of the disease and may lead to more important results.

David, V. C.: Papillomata of the Large Bowel. *Ann. Surg.*, 1925, lxxxii, 109.

Papillomata of the large bowel are found almost exclusively in the adult. When they are situated in the rectum the most prominent sign of their presence is the passage of bright red blood with the stools. A papilloma which is attached low may prolapse when the bowels move. The absence of pus differentiates papilloma from carcinoma. Unchecked bleeding may lead to secondary anæmia. When the tumor is situated high in the colon the bleeding is intermittent.

Papillomata are lobulated or villous tumors varying in size from that of a pea to that of a child's head. They are rarely pedunculated but have a sessile base with one or more attachments. In consistency they are soft and sponge-like and without induration at their bases. They have little tendency to recur. Those of the pedunculated type consist in a connective tissue framework containing blood vessels, fibroblasts, and round-cell accumulations. The basement membrane of the tumor is intact. In the more common sessile type, the papillary structure seems to spring from the mucosa of the bowel and has little of the adenomatous character of the mucosa. Papillomata of the large bowel are regarded as potentially malignant.

The author reports two cases of papilloma high up in the colon which were presumed to be malignant. In one there was a filling defect just below the splenic flexure. In the other the tumor was situated at the ampulla of the rectum and there was no fixation of the bowel wall. In five other cases the tumor was found in the rectum, within reach of the examining

finger. Only one of the growths in these cases was pedunculated, but all except one had the usual characteristics of benign papillomata.

The author believes that unless papillomata can be proved benign they should be treated as malignant by the usual resection of the bowel. In a case of papilloma that is known to be benign the tumor may be excised from below and the mucosa partially closed. When the tumor is high up it may be fulgurated through the proctoscope with cauterization of its base. Local anæsthesia is usually employed. The article is supplemented by a number of photomicrographs of pathological sections.

WILLIAM J. PICKETT, M.D.

Gray, Sir H.: Physical Factors in the Production of Appendicitis: Points in the Diagnosis; Their Influence on Surgical Treatment. *Illinois M. J.*, 1925, xlviii, 33.

The author believes that in 75 per cent of the cases appendicitis is due to anatomical conditions resulting from developmental malarrangement of the viscera in the neighborhood of the appendix. The pathological changes are produced by stagnation of the contents of the bowel resulting from excessive mobility of the cæcum.

Abnormal position of the appendix, modern artificial life, improper food, and the frequent use of a cathartic predispose to appendicitis. The appendix is found in a great variety of positions and is involved by a great variety of membranes or developmental adhesions in the right side of the abdomen.

Many cases of so-called chronic appendicitis are not cured by the removal of the appendix because the recurring pains are due to other conditions which require more extensive interference. In many cases of this type a cure can be effected by colopexy.

The pre-operative signs of chronic appendicitis are tenderness over McBurney's point and 1½ in. below and to the left of the umbilicus. The presence of an area of superficial hyperæsthesia over McBurney's point is suggestive of chronic appendicitis. The X-ray is of value in revealing adhesions constrictions and the situation and fixity of the appendix.

The failure of appendectomy to give relief in cases diagnosed as chronic appendicitis is due to the dragging, distention, or pressure of a large and unduly mobile colon. Except in fat persons, such a colon can be detected by palpation. It gurgles and rolls under the fingers. Fixation of an abnormally mobile colon relieves the dragging pain and discomfort permanently.

H. HOYT COX, M.D.

Muller, G.: Technical Aspects of Acute Appendicitis. *Atlantic M. J.*, 1925, xxviii, 749.

This article is based on the findings and results in 101 consecutive cases of acute appendicitis which were operated upon in the period of a year.

A localized abscess was found in only ten cases. There were thirty-eight cases of simple appendicitis, twenty-two cases of appendicitis with purulent fluid, and forty-one cases of perforative or gangrenous appendicitis (nine with abscess and thirty-two with diffuse peritonitis).

That a certain number of cases of appendicitis will recover without operation was shown by the fact that in twenty cases operated upon late in the condition only a local disturbance was found.

The mortality in the series was 4.9 per cent, which corresponds generally with the statistics from other clinics and larger series of cases.

In discussing the time at which operation should be performed the author states that delay is sometimes of value not only to allow localization but also to increase the patient's resistance by the free administration of water, stimulation of the heart by digitalis, and the quieting of peristalsis by the withholding of food and liquids.

The ideal anæsthesia is obtained by local nerve blocking and the administration of sufficient nitrous oxide to produce analgesia, but in many cases ether must be given with the nitrous oxide to obtain sufficient relaxation.

In ninety-seven cases the McBurney incision was used. This is preferred to the right rectus incision because it renders the appendix more accessible and causes less exposure of the small intestine.

Instead of a gauze sponge in the abdominal cavity, the author uses an aspirator for the continuous removal of pus and blood during the operation.

In fifty-one of the cases reviewed the abdomen was closed without drainage. In ten of these there was free fluid in the abdomen. The author believes that it is impossible to drain the abdominal cavity thoroughly. Following a review of the arguments for and against drainage, he states that if there is no spread of the infection it is not necessary to drain the acutely inflamed appendix, even when gangrene is present.

When drainage is advisable he introduces one or two rubber tubes into the pelvis and one or two large cigarette drains into the fossa beneath the cæcum. The cigarette drains are usually removed by the fifth day. Occasionally loin drainage is instituted. The drains are placed very carefully to prevent pressure on the coils of intestine. The danger of the formation of fistulæ subsequently is decreased by care in the application of the drainage tubes. The external wound is kept clean by the frequent use of 1 per cent mercurochrome solution.

In the routine after-treatment the patient is put in a semi-sitting position, continuous enteroclysis of tap water and continuous hypodermoclysis of normal salt solution (Bartlett method) are used, and morphine is given at frequent intervals. In mild cases the morphine is given every six hours and in severe cases every two hours, the respirations being reduced to twelve per minute. The importance of rendering the patient free from pain by the use of morphine is emphasized.

In cases of peritonitis, four ice bags are used when the temperature is 101 degrees F., eight ice bags when it is 102 degrees, and twelve ice bags when it is 103

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Many cases of so-called chronic appendicitis are not cured by the removal of the appendix because the recurring pains are due to other conditions which require more extensive interference. In many cases of this type a cure can be effected by colopexy.

The pre-operative signs of chronic appendicitis are tenderness over McBurney's point and 1½ in. below and to the left of the umbilicus. The presence of an area of superficial hyperæsthesia over McBurney's point is suggestive of chronic appendicitis. The X-ray is of value in revealing adhesions constrictions and the situation and fixity of the appendix.

The failure of appendectomy to give relief in cases diagnosed as chronic appendicitis is due to the dragging, distention, or pressure of a large and unduly mobile colon. Except in fat persons, such a colon can be detected by palpation. It gurgles and rolls under the fingers. Fixation of an abnormally mobile colon relieves the dragging pain and discomfort permanently.

H. HOYT COX, M.D.

Muller, G.: Technical Aspects of Acute Appendicitis. *Atlantic M. J.*, 1925, xxviii, 749.

This article is based on the findings and results in 101 consecutive cases of acute appendicitis which were operated upon in the period of a year.

A localized abscess was found in only ten cases. There were thirty-eight cases of simple appendicitis, twenty-two cases of appendicitis with purulent fluid, and forty-one cases of perforative or gangrenous appendicitis (nine with abscess and thirty-two with diffuse peritonitis).

That a certain number of cases of appendicitis will recover without operation was shown by the fact that in twenty cases operated upon late in the condition only a local disturbance was found.

The mortality in the series was 4.9 per cent, which corresponds generally with the statistics from other clinics and larger series of cases.

In discussing the time at which operation should be performed the author states that delay is sometimes of value not only to allow localization but also to increase the patient's resistance by the free administration of water, stimulation of the heart by digitalis, and the quieting of peristalsis by the withholding of food and liquids.

The ideal anæsthesia is obtained by local nerve blocking and the administration of sufficient nitrous oxide to produce analgesia, but in many cases ether must be given with the nitrous oxide to obtain sufficient relaxation.

In ninety-seven cases the McBurney incision was used. This is preferred to the right rectus incision because it renders the appendix more accessible and causes less exposure of the small intestine.

Instead of a gauze sponge in the abdominal cavity, the author uses an aspirator for the continuous removal of pus and blood during the operation.

In fifty-one of the cases reviewed the abdomen was closed without drainage. In ten of these there was free fluid in the abdomen. The author believes that it is impossible to drain the abdominal cavity thoroughly. Following a review of the arguments for and against drainage, he states that if there is no spread of the infection it is not necessary to drain the acutely inflamed appendix, even when gangrene is present.

When drainage is advisable he introduces one or two rubber tubes into the pelvis and one or two large cigarette drains into the fossa beneath the cæcum. The cigarette drains are usually removed by the fifth day. Occasionally loin drainage is instituted. The drains are placed very carefully to prevent pressure on the coils of intestine. The danger of the formation of fistulæ subsequently is decreased by care in the application of the drainage tubes. The external wound is kept clean by the frequent use of 1 per cent mercurochrome solution.

In the routine after-treatment the patient is put in a semi-sitting position, continuous enteroclysis of tap water and continuous hypodermoclysis of normal salt solution (Bartlett method) are used, and morphine is given at frequent intervals. In mild cases the morphine is given every six hours and in severe cases every two hours, the respirations being reduced to twelve per minute. The importance of rendering the patient free from pain by the use of morphine is emphasized.

In cases of peritonitis, four ice bags are used when the temperature is 101 degrees F., eight ice bags when it is 102 degrees, and twelve ice bags when it is 103

degrees, according to the suggestion made by Crile for the treatment of fever following thyroidectomy. In the cases of seriously ill patients, blood transfusion is frequently resorted to, and lately, in advanced cases, a 1 per cent solution of gentian violet has been given.

In acute cases purgatives are never administered for at least a week after the operation.

HAROLD M. CAMP, M.D.

Forbus, W. D.: Argentaffine Tumors of the Appendix and Small Intestine. *Bull. Johns Hopkins Hosp.*, Balt., 1925, xxxvii, 130.

Argentaffine tumors may occur at any point in the gastro-intestinal tract below the œsophagus and may be single or multiple. They never produce symptoms or signs *per se*. They are usually confined to the wall of the intestine, but may extend into the mesentery and in rare cases to the lymph nodes. The occurrence of metastases to remote parts is extremely doubtful. The incidence of these tumors in the appendix is about 0.4 per cent. They are most frequent in the appendix between the ages of 20 and 30 years.

Attention is called to the fact that the term "carcinoma" has been erroneously applied to a group of small tumors occurring either singly or in numbers in the appendix and small intestine and bearing a morphological similarity to true carcinoma of these organs.

The author reports six cases of so-called carcinoma of the appendix and small intestine in which the argentaffine or chromaffine character of the cells described by Gosset and Mason was found.

Carcinomata or carcinoids of the appendix and small intestine have their origin in the cells of Kultschitsky and Schmidt of the crypts of Lieberkuehn and therefore are tumors of the chromaffin system. They may be spoken of as argentaffine tumors because of the peculiar ability of the granules of the tumor cells to reduce an ammoniacal solution of silver.

The argentaffine tumors are generally harmless.

The author reviews the literature, tracing the development of the various theories regarding the so-called carcinomata or carcinoids of the gastro-intestinal tract. MARCUS H. HOBART, M.D.

Hertz, J.: Three Cases of Megasigmoid, One with Volvulus; Three Cures Following the Mikulicz Operation (Trois observations de mégacôlon sigmoide dont l'une avec volvulus; trois opérations selon la méthode de Mikulicz; trois guérisons). *Bull. et mém. Soc. nat. de chir.*, 1925, li, 494.

In one of the cases of megasigmoid reported in this article the condition was complicated by volvulus; in one by megacæcum; and in two by appendicitis. In each case the operation of Mikulicz was performed—colostomy with suture of the afferent and efferent loops of bowel and subsequent resection of the redundant sigmoid and destruction of the partition between the two lumina with the crushing forceps. The postoperative course was ideal, and definite cures resulted.

The author believes that the Mikulicz operation is the treatment of choice. It can almost always be performed with relative ease, even in the presence of serious pathological changes, and in itself is practically without danger to life. Immediate resection followed by anastomosis is frequently very successful, but exposes the patient to a grave risk, especially in the presence of inflammation.

In the author's case with megacæcum the caliber of the cæcum was reduced by longitudinal plication. The X-ray demonstrated that this reduction was maintained. Hertz attributes the success of this treatment largely to the removal of the cause, the obstruction caused by the distended sigmoid.

ALBERT F. DEGROAT, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Muller, G. P., Ravdin, I. S., and Ravdin, E. G.: Bile Pigment Metabolism in Biliary Tract Disease. *J. Am. M. Ass.*, 1925, lxxxv, 86.

The authors regard the Van den Bergh test as a valuable method of investigating the pigment metabolism of the liver. In twenty-eight cases the bilirubin content of the blood was studied, and in eighteen a section of the liver was removed later at operation and subjected to microscopic examination. A comparison of the findings of the test with the findings made at operation suggests that the test may prove of value in estimating the extent and permanence of damage to the hepatic cells.

JOHN W. NUZUM, M.D.

McNee, J. W., and Keefer, C. S.: The Clinical Value of the Van den Bergh Reaction for Bilirubin in Blood: With Notes on Improvements in Its Technique. *Brit. M. J.*, 1925, ii, 52.

The authors describe the technique of Lepehne's modification of the Van den Bergh reaction for bilirubin in the blood. They recommend this method for the direct qualitative test. They describe also the Thannhauser and Andersen improvement of the technique for the indirect reaction for the quantitative estimation of bilirubin and give directions for the preparation of a new artificial standard solution described by Van den Bergh to replace the iron rhodanate ethereal solution.

They believe that the Van den Bergh test is the best test so far devised for the clinical determination of the bilirubin content of the blood serum or plasma. The qualitative reaction may render possible a positive diagnosis of obstructive or hæmolytic jaundice, and except in the stage of rapid temporary improvement it distinguishes also between pernicious anæmia and secondary anæmias. In the most common type of jaundice, the toxic and infective type, it usually gives no information of diagnostic or prognostic value, but is of great value for the detection of latent jaundice. J. FRANK DOUGHTY, M.D.

Lobingier, A. S.: Drainage in Infection of the Liver, Bile Ducts and Gall Bladder. *J. Am. M. Ass.*, 1925, lxxxv, 85.

Lobingier advocates a rather unique method for surgical drainage in infection of the gall bladder, bile ducts, and liver. He believes with Graham that hepatitis is associated with most gall-bladder and bile-duct infections and that, accordingly, only slight relief can be hoped for from simple drainage of the gall bladder.

In the procedure described cholecystectomy is performed with preservation of the proximal end of the cystic duct, and through the proximal end of the cystic duct a rubber catheter is inserted and sutured. By means of this catheter the liver and ducts are drained without danger of stricture of the common bile duct. In suitable cases Lobingier has obtained excellent results from this method.

JOHN W. NUZUM, M.D.

Soederlund, G.: A Case of Stone in the Biliary Tract with Cystic Dilatation and a Diverticulum of the Common Bile Duct. *Acta chirurg. Scand.*, 1925, lix, 253.

The patient whose case is reported was a male 45 years of age who for more than ten years had had recurrent attacks of severe biliary colic accompanied as a rule by icterus and fever.

Operation revealed a stone firmly lodged in the papilla of Vater, numerous stones in the gall bladder, and two cyst-like swellings of the common duct each of which was the size of a goose egg. The swelling nearest the liver was a typical diverticulum protruding laterally by a small neck from the wall of the duct, while the swelling nearer the duodenum was a circumscribed dilatation of the duct itself which tapered toward each end.

A cholecystectomy was done; the diverticula, which also was found to contain stones, was excised; the dilated duct was cleared of stones and gravel; and the stone lodged in the papilla of Vater was removed by means of a transverse duodenal incision.

The patient left the hospital six weeks after the operation quite restored to health, and one year later was still entirely well.

The author believes that the two curious dilatations of the common duct in this case belonged to the same category as the so-called idiopathic cysts of the choledochus. The case seems to indicate that so-called idiopathic cysts of the choledochus are congenital.

Buedinger, K.: Occlusion of the Biliary Passages by Cholesterol Sand (Verstopfung der Gallenwege durch Cholesterinschlamm). *Arch. f. klin. Chir.*, 1925, cxxxv, 406.

The disease picture due to cholesterol sand is intermediate between that of cholangeitis without stones and cholelithiasis. The author reports the following three cases:

CASE 1. The patient was a male 18 years of age who gave a history of repeated attacks of colic in the right hypochondrium. Occasionally the gall bladder became palpable. The disease picture of septic inflammation of the biliary tract developed suddenly. At operation the slightly enlarged and thickened gall bladder was found to contain 20 c.cm. of a slightly cloudy fluid. In the cervical portion and densely packed in the cystic and common ducts was a yellowish-green sand. The hepatic duct contained bile mixed with flakes of pus. Recovery resulted.

CASE 2. The patient was a woman 48 years old who had had repeated attacks of colic without jaundice. At operation the gall bladder and the hepatic duct as far as the ducts of the second grade were found filled with a slimy mass. Operation was followed by recovery.

CASE 3 was that of a 52-year-old woman who for thirty years had had symptoms of cholelithiasis and occasionally jaundice. After a particularly severe attack, the symptoms of acute peritonitis developed. Operation was performed on the diagnosis of pancreatitis, but acute cholecystitis was found. The gall bladder was removed. After eleven months the colic recurred with vomiting, and after nineteen months a second operation was done. The hepatic and common ducts were then found embedded in cicatricial tissue and densely filled with sandy masses. A larger mass was discovered in the papilla. These masses became looser in the direction of the liver. Chemical examination showed them to consist chiefly of bile-stained cholesterol and very small quantities of calcium salts. The patient died after the second operation.

Clinically this disease picture belongs to the group of conditions which includes cholangeitis. The important feature is the occlusion of the large biliary ducts by masses of cholesterol. The gall bladder also may be filled with the same material. It is probable that the cholesterol is deposited gradually during the attacks. As is evident from the author's third case, involvement of the gall bladder is not essential. Occlusion of the papilla occurs quite frequently, but as this does not cause lasting icterus it is evident that the occlusion produces only an occasional hindrance to the outflow of bile. Outside of the body the cholesterol sand immediately becomes changed into brittle concretions. However, it cannot be said with certainty that true cholesterol stones originate in this way.

The treatment is surgical. In addition to removal of the gall bladder, a cleansing of the biliary ducts and measures to promote the flow of bile are indicated.

SCHUBERT (Z).

Gosset, A.: Choledochotomy for Lithiasis (De la cholédocotomie pour lithiase). *Presse méd.*, Par., 1925, xxxiii, 497.

Lithiasis of the common duct may occur with or without icterus. In this condition there are generally intermittent attacks of fever. If such attacks occur in a non-icteric case of gall-bladder disease the possibility of stone in the common duct should always

be thought of. As a matter of fact, the common duct should be examined in every operation for gall stones.

Before operation, an examination should be made for azotæmia, the bleeding time and coagulation time should be determined, and an X-ray examination should be made.

At operation, the author places the patient on the table with his feet a little lower than his head and places a sandbag under his back at the lower end of the scapula. A transverse incision at the lower border of the liver is preferable to Kehr's incision. The liver should be lifted up to expose the gall bladder. It is generally necessary to free adhesions between the duodenum and gall bladder, and this should be done carefully, keeping close to the gall bladder so as not to perforate the duodenum. The gall bladder should be left until the common duct has been examined and operated upon if necessary.

Often the gall bladder is atrophied and need not be removed. To expose the common duct the duodenum must be pushed down with a compress. The common duct is easily recognized by its appearance and color. Frequently it is dilated and its walls are thickened or rigid. Palpation often reveals the presence of stones. The common duct should be opened as near as possible to the duodenum, and internal exploration should be made with a metal instrument with which stones can be felt. The duct should be examined with extreme care as it often contains many stones and some of them may be very minute.

As a rule the duct should not be closed, but in certain favorable cases with no signs of angiocholitis its closure is possible. In such favorable cases Duval puts a drain in the common duct, passes it through the ampulla of Vater into the duodenum, and closes the common duct. In general, however, drainage is necessary. The drain should be left in as long as possible—in old cases as long as thirty days—and there should be continuous aspiration night and day. Wicks, generally three in number, should be placed around the drain and left in for from ten to twelve days.

Pulmonary complications are rare. If the bile drains freely, the prognosis is good. After recovery from the operation the patient should be given dietetic treatment and for one or several years treatment at Vichy. In apyretic cases the mortality is 5 per cent, but in cases in which icterus has been present for a long time and the patient is operated on during pyrexia it may be as high as 15 per cent.

AUDREY G. MORGAN, M.D.

Coffey, R. C.: Surgery of the Gall Tracts. *Northwest Med.*, 1925, xxiv, 326.

Gall-tract surgery is difficult and highly technical. Normal appearing gall bladders should not be removed merely because of pain in the right side of the abdomen as defective fixation of the ascending colon will produce this symptom. In cases with stones, infection, or jaundice, organic surgery is required.

Coffey reports a case in which cholecystectomy was performed two months ago. Following the operation the patient developed a biliary fistula and became deeply jaundiced. At a second operation a ¾-in. break in the continuity of the common duct was found. No stones were present. The lower end of the duct was dilated, a piece of a No. 16 catheter was inserted into both ends, and the omentum was brought across the tube and sewed to the neighboring peritoneum, so that it covered the exposed tube. At the upper end of the common duct the omentum was left loose to provide adequate drainage and gauze drains were inserted. The tube functioned perfectly, and one year after the operation the patient was in perfect health.

The method of reconstructing the common duct by leaving a permanent tube was devised by Wilms. C. H. Mayo made a good connection by means of the funnel-shaped end of a catheter which he supplied with two flanges ½ in. apart to prevent it from entering the duodenum.

In the April, 1923, number of the *Surgical Clinics of North America*, Stetten reported two cases of reconstruction of the common duct. In one, the common duct had been tied in the same ligature as the cystic artery and the tissues had been divided distal to the ligature. Stetten discovered the error immediately and repaired the duct by anastomosis.

In the October, 1923, number of the *Surgical Clinics of North America*, Schwytzer reported the complete excision of the hepatic duct. He repaired the duct two days later by inserting a catheter into the two ends.

An anomalous arrangement of the blood vessels or bile ducts may cause disastrous results in operations performed by even the most capable surgeon.

Infection of the gall tract constitutes one of the most serious of surgical conditions. The author reports the case of a 59-year-old man who had been subjected to cholecystostomy with removal of stones and who ten years later presented every evidence of a severe septic condition of the gall tract with the exception of jaundice. A large stone was removed from the common duct, and the gall bladder, which also contained stones, was removed. A tube was then placed in the common duct, gutta percha sheets were placed around the gall-tract region, and numerous gauze wicks were inserted into the field of operation. The patient recovered after a stormy convalescence.

Gauze properly handled and properly protected becomes in many instances a most valuable agent in abdominal surgery. This is true particularly when it is used for the purpose of walling off a septic or denuded area from the free peritoneal cavity. The gauze should be separated from the peritoneal cavity with gutta percha tissue or rubber dam. This prevents adhesions and renders the area extraperitoneal. In the author's cases the gauze wicks are removed on the sixth day under nitrous oxide anæsthesia and the gutta percha is removed a week later. This method effects a complete cure and prevents the

formation of serious adhesions, especially in pelvic and abdominal conditions. H. Hoyt Cox, M.D.

Haggard, W. D.: Some Debatable Points in the Surgery of the Gall Tract. *Surg., Gynec. & Obst.*, 1925, xli, 92.

In 85 per cent of 345 cases of gall-bladder disease exclusive of stone in the common duct, the gall bladder was removed instead of drained. Gall stones were found in 70 per cent. The total mortality in both groups was 4.04 per cent.

The majority of gall-bladder infections are satisfactorily diagnosed but in some cases the symptoms are not associated with definitely recognizable pathological lesions. Attention is called to the fact that a normal gall bladder is blue, but a blue gall bladder is not always normal. In some cases it is necessary to open the gall bladder to make a diagnosis. The strawberry gall bladder with its elevated whitish areas should be removed. When the lining of the gall bladder appears normal Judd removes a section of the wall for pathological examination, and if it is negative he closes the incision without removing the organ. Crile decides regarding the surgical measures to be employed from inspection and palpation.

The theory of focal infection advanced by Rosenow has been responsible for advances in prophylaxis as well as in treatment. W. J. Mayo has emphasized that certain forms of cardiac diseases are associated with, if not caused by, gall-bladder infection. Hypertension and arthritis are other complications which are benefited by operation on the gall bladder.

Mayo and Moynihan have stressed the relationship between appendicitis and cholecystitis and most surgeons agree that, if feasible, the appendix should be removed at the time of the operation on the gall bladder if it shows any pathological change. Acute pancreatitis is a frequent result of the presence of gall stones and obstruction of the common duct.

The gall bladder should never be removed when there is a history of jaundice or other evidence of obstruction as it may be necessary later to use it to sidetrack the bile to the stomach or duodenum. Chronic biliary cirrhosis has been proved to follow infection of the gall bladder and is benefited by treatment of the infection.

Graham has shown that infection of the gall bladder is probably secondary to infection of the liver, and Strachauer suggests the removal of a specimen of liver for microscopic examination when it is impossible to determine the condition of the gall bladder from its appearance at the time of operation.

Gall-stone disease and glycosuria have a fairly definite relationship. Patients with diabetic pancreatitis can be very satisfactorily prepared for operation by the administration of insulin. In some cases the sugar disappears permanently from the urine.

In the Rosenthal test of liver function with phenolsulphonephthalein retention of more than 8 per cent of the dye at the end of eight minutes is considered abnormal.

Operations upon the gall bladder or ducts may be followed by death from hepatic insufficiency. Hepatic insufficiency is of three types. The first type is characterized by vasomotor depression; the second, by coma developing gradually after four or five days; and the third by coma coming on immediately after the operation.

The X-ray diagnosis of gall-bladder disease has been rendered more exact by the Graham-Cole technique, but nothing is superior in the diagnosis to a well-taken and carefully recorded history as a roentgenogram that is negative for stones means nothing.

Operation for acute cholecystitis should be avoided in the acute stages as death from this condition is rare. The only exceptions are the severe gangrenous type and very early cases without pathological changes which will make the operation difficult.

For the pre-operative preparation of jaundiced patients the author recommends the daily intravenous injection of from 5 to 10 c.cm. of a 10 per cent solution of calcium chloride in water for three days, as suggested by Walters. Merle R. Hoon, M.D.

Stewart, W. H., Einhorn, M., and Ryan, E. J.: Recent Advancements in Cholecystography. *N. York State J. M.*, 1925, xxv, 825.

Visualization of the gall bladder by the method introduced by Graham, Cole, and Copher is a distinct advance in the diagnosis of gall stones and gall-bladder disease. It reveals the size, shape, location, and emptying power of the gall bladder and frequently renders non-opaque gall stones visible as negative shadows in the opaque bile or impregnates them sufficiently so that they cast positive shadows.

Failure of the gall bladder to cast a shadow after proper application of the method usually indicates the presence of pathological changes. In cases without obstructive jaundice, such changes include obstruction of the cystic duct, obliteration of the lumen of the gall bladder, thickening of the gall-bladder wall, unusual concentration of the residual bile, and defective liver function.

Visualization of the gall bladder is prevented also by obstructive jaundice, shrinkage of the gall bladder with intermittent obstruction of the common duct, obstruction above the juncture of the cystic duct and the common duct with failure of bile to enter the gall bladder, excessive distention of the gall bladder, preventing sufficient concentration of the opaque bile by admixture, and arrest of liver function with continued back-pressure in the biliary system.

The method as first used, involving the intravenous injection of sodium tetrabromphenolphthalein, frequently caused an unfavorable toxic reaction. Subsequently the iodine salt was employed. This is

equally toxic, but as it produces good shadows in smaller doses the reaction following its use is less severe. Later the authors administered the iodine salt into the jejunum through the duodenal tube, but although it was possible to outline the gall bladder satisfactorily by this method, untoward reactions still occurred. Subsequently investigations made by them and results reported by others indicated that satisfactory results could be obtained if the drug was given by mouth. Considerable experience has shown this hypothesis to be correct. The authors now use the oral method in all cases referred to them for roentgenographic examination of the gall bladder. They describe their method of procedure in detail. In none of the fifty-three cases has a severe reaction occurred.

The authors are convinced that the oral method is the safest and best. To be of practical value, however, the information obtained by it must be correlated with the clinical findings, and this can be done only by close co-operation between the surgeon or internist and the roentgenologist.

ADOLPH HARTUNG, M.D.

Bryan, W. A.: Causes of Death in Cholecystitis. *South. M. J.*, 1925, xviii, 524.

In cases of gall-bladder disease, death is due to local, nearby, or remote lesions. Local and nearby lesions are demonstrated at the time of operation and are often considered the most important. Infection may produce cholangeitis, hepatitis with obstruction of the common duct, pancreatitis, suppurative or non-suppurative peritonitis, adhesions, and intestinal obstruction. While these are the more common complications of cholecystitis, they are of no greater importance than the changes which often occur in remote organs.

There appears to be a relationship between myocarditis and cholecystitis. Pathologists agree that infection is one of the most important causes of myocardial lesions. The author believes that cholecystitis is a very potent agent in the production of myocarditis because of its chronicity, its inaccessibility, and its failure to respond to non-operative treatment.

Chronic jaundice is another serious complication. This lowers the pulse and respiratory rate and brings on marked cerebral symptoms. Withdrawal of the bile from the alimentary tract definitely reduces the alteration and absorption of the fats. If long continued, it will reduce the general nutrition of the body. Obstructive jaundice materially alters the structure of the liver, eventually producing necrosis of the hepatic cells. The effect of bile saturation in the remote structures is also liable to produce degenerative lesions. Jaundice not only reduces the coagulability of the blood but may even destroy the endothelium of the capillaries, favoring hæmorrhage.

The longer operation is delayed in cases of gall-bladder infection the greater the damage produced in the vital organs.

CYRIL J. GLASPEL, M.D.

Seulberger, P.: Follow-Up Findings in Patients Operated upon for Gall Stones in the Goettingen Clinic in the Period from 1912 to 1920 (Nachuntersuchungen der in der Goettinger Klinik operierten Gallensteinkranken aus den Jahren 1912–1920). *Deutsche Ztschr. f. Chir.*, 1925, cxc, 1.

Of 304 patients operated upon for gall stones, ninety-eight were re-examined and 119 were sent a questionnaire. Eleven of these 217 patients had died. In four cases the cause of death could not be determined. In the others it was believed to have been due to the gall-stone disease but this could not be established with certainty.

About 80 per cent of the patients became free from symptoms after the operation and 88 per cent fully regained their earning power. Nine per cent had had a second operation. Incisional herniæ developed in 4 per cent.

The causes of persistence of the symptoms were overlooked stones, adhesions, disturbances of innervation (spasms, Head's zones), dilatation of the stump of the gall bladder or cystic duct, postoperative hernia, cicatricial defects, and chronic pancreatitis. In the cases of many of those who still complained of symptoms hyperacidity or anacidity of the gastric contents was found.

In the absence of unmistakable findings, an examination for Head's zones is of value before re-operation.

In several cases paravertebral injections of novocain controlled the postoperative distress which is often attributed to adhesions.

COLMERS (Z).

Bunts, F. E.: Surgical Treatment of Diseases of the Gall Bladder. *Ann. Surg.*, 1925, lxxxii, 232.

This article is based on 1,405 cases of surgical disease of the gall bladder which were treated by the author and his associates. The pathological conditions causing the classical picture of gall-bladder disease include renal stones, Dietl's crisis, pyelitis, diaphragmatic pleurisy, acute pancreatitis, acute appendicitis, perforation of the stomach, angina pectoris, abdominal angina with abdominal arteriosclerosis, pericarditis, epigastric hernia, lead colic, herpes zoster, and the gastric crisis of tabes. In the diagnosis, X-ray studies are of importance secondary only to clinical judgment.

In the last six years the author has performed more cholecystectomies than cholecystotomies. He agrees with Judd that following cholecystectomy the common duct may undergo compensatory dilatation to act as a bile reservoir, and that the more dangerous common duct stone may form. He performs cholecystectomy if there has been an acute attack of cholecystitis; if a stone is present in the cystic duct or there is evidence of the previous presence of a stone; or if the gall-bladder wall is thickened.

Cholecystotomy is the operation of choice if the gall bladder presents a normal appearance and there is no history of an acute attack. Drainage is continued until the bile is free from bacteria.

In a follow-up of 271 patients who were subjected to cholecystectomy and 253 who were subjected to cholecystotomy it was found that 1.9 per cent of the former and 8 per cent of the latter had had a subsequent gall-bladder operation. In 400 cholecystectomies the operative mortality was 1.7 per cent, while in 129 cholecystotomies it was 6.9 per cent.

No operation should be done in case of an acute attack unless empyema of the gall bladder is suggested. When the patient's condition is desperate the author performs a cholecystotomy first and a cholecystectomy later. In the cases of jaundiced patients an attempt is made to decrease the clotting time of the blood by the administration of calcium lactate by mouth, with or without the intravenous injection of calcium chloride; a high-calorie diet is given; and preparation is made for frequent transfusions.

In operating, complete control of bleeding is essential. The introduction of heavy gauze packing down against the liver must be avoided to prevent interference with the circulation of the splanchnic veins. Bile leakage into the peritoneal sac is destructive and causes systemic absorption of bile. Therefore if cholecystectomy is performed the gall bladder must not be opened, and if cholecystotomy is chosen leakage-proof drainage must be established.

The postoperative treatment should include a cholesterin-free diet and the administration of milk of magnesia. J. C. Carver, M.D.

Vincent, B.: Splenectomy in Thrombopænic Purpura Hæmorrhagica. *Boston M. & S. J.*, 1925, cxciii, 191.

The term "thrombopænic purpura hæmorrhagica" is applied to a group of the purpuric diseases in which pathological bleeding is associated with a marked reduction in the number of blood platelets or thrombocytes. This group includes two forms of purpura, one in which the thrombopænia is constitutional or primary, called "Werlhof's disease" or "idiopathic purpura hæmorrhagica," and the other in which it is symptomatic or secondary to some condition such as sepsis, nephritis, drug poisoning, an infectious disease, leukæmia, or disease of the liver.

Primary purpura hæmorrhagica occurs in an acute or chronic form, the latter by far the more frequent, and is usually observed in females under 30 years of age. The clinical picture of this disease is clearly defined and easily recognized, being characterized by purpuric spots in the skin, hæmorrhages from the mucous membranes, the tendency of cuts and traumatized tissues to bleed excessively, the absence of, or a marked decrease in, the blood platelets, a normal or high normal coagulation time, and a non-retractile blood clot.

In purpura hæmorrhagica there is a definite hæmorrhagic diathesis with exacerbations during which the tendency to bleed is increased. Most observers believe that the bleeding is dependent upon lack of normal platelets and changes in the blood vessels.

In 1916, Kaznelson first advocated removal of the spleen in purpura hæmorrhagica. Of the splenectomies for this condition which are reported in the literature, five were followed by death. The author reports five new cases in detail. These included four typical cases of primary thrombopænic purpura hæmorrhagica and one of secondary thrombopænic purpura associated with cirrhosis of the liver. There were no fatalities. The effect of the splenectomy was prompt and favorable; after the operation the bleeding ceased, the number of blood platelets increased, and the bleeding time and clot retractility returned to normal limits.

Splenectomy is indicated as an emergency measure when the bleeding is excessive and cannot be checked by other means and when the patient is incapacitated by persistent bleeding and secondary anæmia. It may be indicated also in milder forms of the disease with recurring attacks of moderate bleeding which are the expression of a persistent hæmorrhagic tendency. Splenectomy is contra-indicated in hæmophilia and, with certain exceptions, in symptomatic or secondary purpura.

Nagy does not concede that splenic activity and platelet deficiency are essential factors in the pathogenesis of the disease. According to his view, chronic purpura hæmorrhagica is due to dysfunction of the ovaries or other glands of internal secretion and the direct cause of the bleeding is increased fragility of the blood vessels. Frank and Kaznelson believe that the compensatory activity of the remaining portions of the reticulo-endothelial systems, the lymph glands and lymphoid tissue of the liver and bone marrow, is not sufficient to vitiate the good effect of splenectomy.

Brill and Rosenthal are of the opinion that the bleeding in purpura hæmorrhagica is due to changes in the blood vessels and to a faulty production of platelets which affects both the quality and the quantity of these bodies. Removal of the spleen restores to the platelets their normal agglutinative and retractile properties, and this improvement accounts for the non-occurrence of renewed bleeding even if the platelets again sink to a very low level after splenectomy. Morris H. Kahn, M.D.

Giordano, D.: The Removal of a Large Spleen from a Patient with Malaria Who Had Had Fever for Several Years (Ablazione di grossa milza in un malarico che da alcuni anni era travagliato da febbre). *Riforma med.*, 1925, xli, 296.

In recent years surgical removal of the spleen has been practiced less and less, but in the author's opinion the operation is of value in cases of large malarial spleens.

Giordano reports the case of a man 27 years of age who had always been well until he contracted malaria seven years ago while he was a soldier. At first, the attacks occurred regularly every other day, but later they became irregular. About two years ago the patient had phlebitis of the left leg.

Examination revealed marked enlargement of the spleen. The urine contained a large quantity of

albumin, some casts, and a few erythrocytes. On its removal the spleen showed congestion. The author regarded this as a postmalarial state due to the malaria, the use of roentgen therapy, and the effect of toxic elements from the intestines.

After the operation the fever ceased but the urine still showed a high content of albumin, many erythrocytes, some leucocytes and hyaline and granular casts, and many bacteria. Two months after the splenectomy the albuminuria still continued and the urine was frequently bloody. Decortication of both kidneys was then done. Specimens excised for microscopic examination showed nephritis and destruction of the epithelium of many contorted tubules. At present, two months after the operation, the albumin in the urine is considerable decreased.

AUDREY G. MORGAN, M.D.

MISCELLANEOUS

Barthels, C.: Retroperitoneal Lymph Cysts (Zur Kenntnis, der Retroperitonealen Lymphcysten). *Beitr. z. klin. Chir.*, 1925, CXXXIII, 307.

Whether the mesenteric and the retroperitoneal cysts of lymphatic origin are to be reckoned among the true lymph-vessel new growths in the sense of cystic lymphangiomata or are to be regarded as the result of merely mechanical processes in the sense of lymphangiectases is a question that still remains unanswered.

The author reports a case in which a cystic tumor the size of a child's fist was removed at operation from the retroperitoneal tissues. This growth was everywhere adherent to the surrounding tissues and had to be liberated at some points by blunt dissection and at others by sharp dissection. It was up against the duodenum and had grown fast to the aorta. The greatest difficulty was encountered in separating it from the vena cava to which it was extensively adherent on its posterior surface. The content of the tumor was a viscid, gelatinous fluid which was partly light yellow and partly pale red as though it were mixed with fresh blood. A macroscopic diagnosis was impossible. The histological structure of the tumor wall showed a close resemblance to that of the lymph and chyle cysts which were described by Henochen.

The author is of the opinion that the neoplasm was a lymphangioma that had developed in a lymph gland.

BODE (Z).

GYNECOLOGY

UTERUS

Strauss, A., and Pomeroy, L. A.: The Treatment with Radium of Uterine Hæmorrhage from Benign Lesions. *Ohio State M. J.*, 1925, xxi, 493.

The fibrous and muscle tissues of the uterus are especially susceptible to the gamma rays of radium. These rays cause gradual shrinkage of the tissue which is easily perceptible after two months, very marked after three months, and usually complete within six months. This change is associated with obliteration of the small blood vessels, a caustic action on the endometrium, and generally a sclerosis of the ovaries.

In order to obtain the shrinkage of a fibroid, sufficient radiation must be given to bring about the menopause. Failure to do this causes a disquieting mental attitude on the part of the patient and allows the tumor to become engorged at the menses and thus to receive a sufficient blood supply to prevent hyalinization and shrinkage.

When the patient is a good surgical risk she should be close to 40 years of age before radium therapy is given preference to surgery for fibromyoma of the uterus.

For a good result in the treatment of myomata with radium after the age of 38 years the entire uterus must not be larger than a six months' pregnancy. Radium is best suited to intramural tumors, but may be applied also to those approaching the uterine cavity or the serosa unless they bulge markedly or are pedunculated.

The presence of pelvic infection, either acute or chronic, is an absolute contra-indication to the use of radium or the X-ray. It is easy to understand how the intra-uterine manipulation necessary for the insertion of a radium tube might stir up an old salpingitis, but fatal peritonitis may follow also the treatment of fibroids complicated by salpingitis with the X-ray alone, without any intra-uterine instrumentation.

In cases of fibrosis of the uterus with little or no enlargement of that organ in women beyond 40 years of age the menstrual periods become irregular, the bleeding is profuse and often lasts for two or three weeks, marked anæmia results, and the patient becomes incapacitated. Destruction of the endometrium with a curette will give relief for only a few weeks. Patients with this condition can usually be spared a hysterectomy and assured of a cure by one application of radium within the uterus of about 1,200 mgm.-hrs. In these cases, as in cases of fibroids, a preliminary dilatation and curettage should be done to rule out malignancy.

Adenocarcinoma of the fundus is not infrequently found associated with polyps. In women under 40 years of age polyps may be the result only of infection, but they are very prone to recur if they are treated by curettage and cauterization alone. The intra-uterine application of radium will prevent their recurrence and cause atrophy of any polyps that have been missed by the curette.

In the cases of young women with essential hæmorrhage it is not desirable to cause the menopause. The treatment therefore consists in the use of 100 mgm. for four hours. This will usually be followed by regular menstruation with a moderate flow. Sometimes, however, the menses will be irregular but of normal amount. Occasionally it may be found that the dose was too small. In such cases it should be repeated, but not sooner than three months afterward.

Most patients are nauseated during the time the radium is within the uterus. This nausea is probably due to the combined action of the anæsthetic, the presence of the foreign body within the uterus, and the action of the radium on the body. The symptoms are almost never so severe as after X-ray treatment, and usually subside promptly when the radium is removed.

The intra-uterine treatment with radium is followed by a whitish discharge from the uterus, beginning about two weeks after the application and continuing for from six to eight weeks. This can be cared for easily by a soda and saline douche once a day or every other day. There may be also some bladder irritability for a week or two after the first week, and rarely there is rectal tenesmus. Rectal tenesmus occurs only when a very high dosage has been given.

In benign as well as malignant lesions of the uterus the most favorable effects from radiation are obtained when the rays reach the lesion without traversing the body. This requirement is best met by the intra-uterine application of radium.

CARL H. DAVIS, M.D.

Watson, B. P.: The Problem of Cancer of the Uterus. *Brit. M. J.*, 1925, ii, 279.

Bonney, V.: Carcinoma of the Cervix. *Brit. M. J.*, 1925, ii, 281.

Cameron, S. J.: Malignant Disease of the Ovaries and Fallopian Tubes. *Brit. M. J.*, 1925, ii, 285.

WATSON states that cancer of the cervix is ten times more common than cancer of the body of the uterus. In multiparæ a common cause of chronic irritation is laceration of the cervix plus chronic leucorrhœa. Repair of cervical lacerations, especially after the child-bearing period, would greatly decrease the incidence of cervical cancer.

Next in importance to prophylaxis comes early diagnosis. This is possible only by very careful

examination of women with leucorrhœa and abnormal bleeding. In addition, an educational campaign should be carried out among the laity.

Cancer of the cervix occurs most commonly between the ages of 40 and 55 years, but in rare instances has been found before the thirtieth year. Cancer of the body of the uterus occurs much later. When irregular bleeding has occurred for more than three months the process is already outside of the cervix and is inoperable. Pain is also a sign of inoperability as it indicates invasion of the parametrium. In the early stages a five-year cure is obtained by radical operation in about 25 per cent of the cases. In inoperable cases the patient can be made more comfortable and her life may be prolonged by the use of radium.

BONNEY is of the opinion that operative treatment is the method of choice for the majority of cases. He performs the Wertheim operation. In a series of 192 cases operated upon by him the primary postoperative mortality was 16 per cent. He removes the uterus, appendages, the entire vagina, all glands that he can reach, and the parametrial and paravaginal tissues. Seventy-eight patients (40 per cent) upon whom a radical operation was done were alive and well after five years. In 25 per cent of the cases the glands were involved at the time of operation but the patient was alive five years later. In 60 per cent of the cases operated upon life was prolonged for at least three years.

CAMERON states that malignant disease of the ovaries and tubes is extremely rare. He records ninety-four cases of malignant disease of the ovaries hitherto unpublished. In eighty-three of these cases the lesion was a cancer. There were twelve cases of sarcoma of the ovary. The duration of life following the operation averaged about five or six months. The operability was between 30 and 45 per cent.

Cancer of the fallopian tube is exceedingly rare. The most prominent symptom of this trouble is a copious clear or blood-stained discharge. In the absence of pathological changes in the cervix or body of the uterus, this is suggestive of a tubal lesion, even though no tumor can be felt in the fornices. Ascites, which is a prominent symptom in cases of ovarian growths, is usually absent.

HARRY W. FINK, M.D.

Burnam, C. F., and Neill, W., Jr.: A Brief Review of the Indications and Technical Procedures Employed by the Authors in the Treatment of Cancers of the Uterine Cervix and Body. *Radiology*, 1925, v, 1.

Taussig, F. J.: Irradiation in Cancer of the Cervix. *Radiology*, 1925, v, 5.

Quigley, D. T.: The Etiology, Pathology, and Treatment of Cancer of the Cervix. *Radiology*, 1925, v, 9.

BURNAM and NEILL remove tissue for microscopic examination in both cancer of the cervix and cancer of the body of the uterus. They believe that radical treatment, either by operation or by radiation, should never be undertaken without this confirmation. They state that there is no evidence that biopsy causes dissemination of the growth.

For most early cases of cancer of the body of the uterus they recommend hysterectomy by the abdominal route, but believe that in cases with considerable relaxation of the vagina, especially those of older patients, the vaginal route is advisable.

They perform an abdominal hysterectomy also in borderline cases of cancer of the body of the uterus because an effective application of radium in such cases is difficult to estimate and because, on account of the size of the uterus, vaginal hysterectomy is often difficult.

When operation is contra-indicated, intra-uterine radiation of 3 gm.-hrs. or more, combined with external through-and-through treatment, should be given. In a number of cases this has resulted in marked improvement in the patient's health.

Burnam and Neill do not advise pre-operative radiation, but four weeks after operation they treat the vaginal vault by means of a flat radium applicator arranged to give 1 gm.-hr. directly to each 3 sq. in. of surface. This takes care of the frequent local implantations. Next, they cross-fire through narrow portals over the iliac glands.

In early cancer of the cervix the line of procedure is less clear than in early cancer of the fundus. Burnam and Neill advocate pre-operative radiation but state that if it were not for the fact that a local recurrence may develop in a previously healed radiated cervix they would discontinue operation.

In the pre-operative radiation, 1 gm.-hr. is given in the cervical canal by means of tubes in tandem, from os to os, and 1 gm.-hr. covering the entire cervix. Operation is performed within a week of the radiation, preferably the next day. When there is involvement of glands, the judicious implantation of radium emanation points at the time of operation has proved of value. Postoperative radiation with radium is not indicated in these cases unless vaginal or local pelvic recurrence has taken place.

In borderline cases of cervical cancer involving the vagina or parametrium, but freely movable, a more general combination of surgery and radiation is advisable than in cases of early cancer. In neither the very early nor the borderline cases should implantation of the parametrium through the vagina be done. When radium alone is used, Burnam and Neill give 3.5 gm.-hrs. in a single treatment applied so that the cervical canal receives 1 gm.-hr. and the surfaces of the cervix and vaginal fornices receive 2.5 gm.-hrs. As a rule the treatment is given without anæsthesia and with the patient in the knee-chest position.

The authors prefer the single dose to the broken dose as the broken dose requires one and one-half times the amount of the single dose. A second treatment is not to be considered before eight weeks, and then only if there is a definite new development.

In advanced cases the only operative measure considered is an exploratory incision to facilitate the implantation of the radium. In addition to the

radiation given in the previous group of cases discussed, a strong emanation point is implanted centrally in the involved parametrium. Great care must be taken in sterilizing the vaginal wall. The needle should be introduced into the mass under the guidance of a finger in the rectum and withdrawn immediately after the ejection of the emanation point.

The authors have found that wide portal X-ray irradiation has not improved their results, and they are of the opinion that it is of value only as a palliative measure in advanced cases.

TAUSSIG states that he now employs from 4,000 to 4,500 mgm.-hrs., at least two-thirds of which is beta radiation with needles or bare silver tubes. This is approximately the same as the 6,500 mgm.-hrs. of gamma radiation employed by Heymann of Stockholm and others.

In recent years Taussig has given from 3,000 to 3,300 mgm.-hrs. in the first treatment and a second dose of from 1,500 to 1,800 mgm.-hrs. four weeks later.

With the patient in the dorsal position with her hips elevated he inserts 50 mgm. in silver into the cervical canal near the internal os, 25 mgm. in silver just beneath it, and 75 mgm. in seven needles encircling the tumor mass.

Taussig states that permanent cures of recurrent nodules in the vaginal vault are extremely rare.

After the application of radium, he delays hysterectomy for four or five weeks. About three weeks after a hysterectomy he usually makes an application of 100 mgm. of radium in silver, brass, and rubber in the vaginal vault for from fifteen to eighteen hours.

QUIGLEY reports sixty-nine cases of early localized carcinoma treated in the period from 1914 to 1921. Of the fifty-one patients who have been traced, thirty-seven are apparently cured. Quigley believes that the most probable cause of cervical cancer is tearing of the cervix and that therefore a torn cervix should be repaired before ulceration and deep infection become established. In cases with a benign ulcer of the chronic type, the lesion should be considered precancerous and the cervix amputated. If proliferation of tissue is evidenced by a hardened edge of new-growth with a tendency to bleed, local treatment with radium should be given and in some cases should be followed by operation.

In borderline and advanced cases, radium should be used to obtain an intensive local effect and the X-ray to obtain a general effect.

Quigley has records of eleven cases of postoperative recurrence which have remained apparently cured for three years. ROLAND S. CRON, M.D.

Ward, G. G., and Farrar, L. K. P.: Radium Treatment of Carcinoma of the Cervix Uteri: Results at the Woman's Hospital After Five Years. *J. Am. M. Ass.*, 1925, lxxxv, 159.

In the Woman's Hospital, New York, the initial dose of radium given is between 2,400 and 3,600 mgm.-hrs. The radium salt is enclosed in tubes, and when the paracervical tissues are involved radium needles are used. Until recently, needles were employed only when the case was definitely in Class 3 or 4. Recently, needles have been used more frequently in the cervicovaginal margins whether they are palpably involved or not. The subsequent dose or repeated doses depend upon the retrogression of the tumor and evidence of reactivity in the cancer cells at a later period.

It is believed that the patient's condition is better after irradiation if the general resistance is fortified by preliminary attention to the general health as far as circumstances will allow. The frequently associated anæmia can often be markedly improved by a prophylactic blood transfusion. Five hundred cubic centimeters of blood administered a few days prior to the treatment will aid the patient to combat the toxins thrown into the system as the result of the local destruction of tissue by the irradiation.

After the first treatment the patient is requested to report once each month to the follow-up clinic, which the authors attend, and if at the end of six or eight weeks the cervix does not show the desired contraction and pallor due to the development of scar tissue and occlusion of the blood vessels, a second treatment is advised, usually a repetition of the initial dose. The administration of subsequent treatments depends on the evidence of cell activity. Some of the authors' most striking results have followed several irradiations.

It is pointed out that many of the subsequent treatments may consist only in the implantation of needles in small suspicious areas that have developed since the previous inspection. The prompt application of the radium to such suspicious areas will stamp out the rekindling fire before it gains dangerous headway.

The tissue removed for examination may be of one type in one area and of another type in another area. The dosage sufficient to cause the complete disappearance of the condition for five or six years in one case may not be sufficient to retard it or cause its retrogression in another case with pathological findings of the same nature and extent.

The initial dose of radium should be a test dose to ascertain the reaction of the malignant growth and of the normal tissues to radium activity. It has been the authors' aim to give a dosage only sufficient to inhibit the tumor growth and produce scar tissue in the cervix and adjacent structures. It is by the production of dense scar tissue that the blood vessels are occluded and the cancer cells are starved and isolated.

Regular monthly visits by the patient and inspection by the surgeon are absolutely necessary to check renewed activity of the malignant growth in its incipience by subsequent radium treatments.

The authors believe that if they succeed in arresting the progress of the disease by inhibiting the growth and imprisoning the cancer cells in cicatricial connective tissue, it is dangerous to open up these barriers by the trauma incident to hysterectomy

and that therefore it is better to rely upon radium treatment alone. CARL H. DAVIS, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

Allen, E., Pratt, J. P., and Doisy, E. A.: The Ovarian Follicular Hormone: Its Distribution in Human Genital Tissues. *J. Am. M. Ass.*, 1925, lxxxv, 399.

The authors determined the amount of active substance that can be extracted from different human genital tissues. This is measured in rat units by means of a decisive anatomical and physiological reaction of the genital tract of the spayed rat to injected lipoid extracts. The follicular hormone is present in greater concentration in large ovarian follicles of women than in those of pigs.

In pigs and cows, the secretion of this hormone ceases or wanes rapidly following ovulation; in women, it is continued for a considerable period after ovulation by the corpus luteum. It seems possible that this may prove to be one of the principal factors determining the difference between the œstrous cycle of lower mammals and the menstrual cycle of primates. Extracts made from placentæ from women and cows gave the same growth reaction in test animals as the ovarian follicular hormone.

The human corpus of the first and third months of pregnancy contains some active substance, but the placenta contains much larger quantities of it. The evidence presented indicates that the corpus can be excised as early as twenty days after the last menstruation without interfering with normal gestation; consequently, this endocrine function of the corpus in woman during this time does not seem to be a necessary one.

Two possible explanations of placental endocrine function are: (1) that the hormone extracted from the placenta is elaborated there, and (2) that after being formed in the ovarian follicles it is retained there or (in woman) in the corpus luteum. Further experimental evidence is necessary to settle this point. Whichever explanation is correct, the balance of endocrine function between the ovaries and placenta offers a fertile field for future investigation.

E. L. CORNELL, M.D.

MISCELLANEOUS

Ward, G. G.: The Gynecology of Tomorrow, with Some Remarks on Uterine Retrodisplacement. *Ohio State M. J.*, 1925, xxi, 481.

Those who can see in the gynecic art only the cutting and sewing of pelvic organs may be led to assume from the present perfection in operative technique in all branches of surgery that there is little more to be known or accomplished in gynecology. However, such persons have not yet awakened to the fact that in recent years this branch of medicine has been undergoing a steady expansion and that today it includes sociological studies with regard to the evolutionary development of woman, her fitness for marriage and childbearing, her sexual psychology, and her degeneracies under modern social conditions. There is a vast field for scientific research in obstetrical and gynecological problems as yet scarcely touched.

It is evident that in order to reach a correct understanding of the vital processes of life we must apply to the living human body the three fundamental sciences of physics, chemistry, and biology. The study of medicine of the future will be the study of biological science.

Our bodies are living biochemical laboratories in which there is constantly taking place a cellular metabolism of which at present we have only a superficial knowledge. The chemical and physical changes occurring in the blood and vessels, the nerve centers, the individual cells, and the endocrine glands, during the processes of menstruation, ovulation, conception, and pregnancy, and during anæsthesia, the trauma of operation, etc., are still to be discovered. CARL H. DAVIS, M.D.

Frank, R. T., Frank, M. L., Gustavson, R. G., and Weyerts, W. W.: The Demonstration of the Female Sex Hormone in the Circulating Blood. I. Preliminary Report. *J. Am. M. Ass.*, 1925, lxxxv, 510.

In a previous article the authors reported that the follicle fluid, corpus luteum, and placenta contain the same hormone. Until the chemical nature of this hormone is better defined, they will call it the "female sex hormone." For the three endocrine glands involved they have coined the collective term "gestational gland" to designate their function.

In this article they report that the female sex hormone is present at times in demonstrable quantity in the circulating blood.

They obtained the blood of five sows in œstrus, five sows not in œstrus, and one bull; injected an alcohol-benzene extract of each of these blood specimens into one or more castrated rats and studied the vaginal smears. None of the anœstrous bloods or the male blood gave a positive reaction. Of the five bloods obtained from animals in œstrus, four gave positive results with a total dosage of 75 mgm. of the crude extract. With the methods of extraction used today, at least 300 c.cm. of œstrous blood is necessary to obtain the 75 mgm. of extract necessary for the test.

Even with the present crude and not quantitative methods of concentration, these results show that the female sex hormone can be recovered from the circulating blood and that the quantity in circulation is greater during œstrus than during the interval between œstral periods. ROLAND S. CRON, M.D.

Sharlit, H., Corscaden, J. A., and Lyle, W. G.: Symptoms Associated with the Menstrual Cycle and the Effects Thereon of Ovarian Therapy. *Am. J. Obst. & Gynec.*, 1925, x, 246.

The authors state that the "flash" symptom in women may serve as a guide to the treatment of

clinical conditions generally recognized as neuroses. They describe three syndromes with this symptom in which the administration of desiccated whole ovary proved beneficial. EDWARD L. CORNELL, M.D.

Kovacs, F.: Influencing the Fertility of the Female White Rat by Treatments with Placental Tissue. *Am. J. Obst. & Gynec.*, 1925, x, 232.

In experiments on white rats Kovacs found that the injection of placental extract rendered 56.3 per cent of the animals temporarily sterile. On the other hand, all but one of the control animals which were not given such injections and rats which were injected with testicular extract became pregnant within a week after being placed with the male.

The author states that in order to determine whether the sterility is the result of an early abortion followed by resorption of the products of conception or an alteration of ovarian function which inhibits the maturation of the follicles or gives rise to ova of less than average vitality, further research must be done on animals larger than the rat in which the duration of pregnancy is longer. The isolation of the component of the placenta which produces the relative sterility would be of great importance

E. L. CORNELL, M.D.

Anspach, B. M., and Jones, H. W.: The Treatment of Secondary Anæmia by Blood Transfusion Preceding Operation for Myoma Uteri and Pelvic Inflammatory Disease. *Am. J. Obst. & Gynec.*, 1925, x, 222.

The authors use the Unger whole blood method which permits the transfusion of undiluted blood without coagulation or the injection of air. In cases in which the anæmia is due to an acute hæmorrhage, they have found it of no value to give amounts larger than 400 or 500 c.cm. Four days are allowed to elapse between the transfusions. Reactions do not occur as often after transfusion with whole blood as after transfusion with citrated blood.

EDWARD L. CORNELL, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Thoms, H.: Pelvimetry of the Superior Strait by Means of the Roentgen Ray. *J. Am. M. Ass.*, 1925, lxxxv, 253.

The first procedure in pelvimetry is the identification of two points on the body of the patient which will identify the plane of the superior strait. These are located anteriorly 1 cm. below the superior border of the symphysis and posteriorly at the depression just below the spine of the fourth lumbar vertebra. An imaginary line extending between them traverses the anteroposterior diameter of the superior strait.

With the patient in the ordinary sitting posture, it is noticed that the symphysis rests in a plane much higher than that of the promontory of the sacrum, but when she assumes a position in which her back is arched it is noticed that as the back becomes arched the symphysis is lowered and the promontory raised so that the plane of the superior strait becomes horizontal. With the patient in the latter position and the target or tube placed over the center of the plane, an exposure projects on the sensitive plate a slightly and equally enlarged shadow of the inlet of the pelvis.

The problem then is to determine the exact degree of this enlargement so that accurate measurements may be made. This problem is solved by the use of a lead strip notched in the form of a rule, which is laid over the plate itself when the exposure is made. The strip is so ruled that the distance between adjoining notches represents the distance of 1 cm. in the plane of the superior strait. The ruling of these lead strips is determined as follows:

If a lead screen composed of strips of lead 1 cm. wide is placed in a plane 11 cm. above the sensitive plate and an exposure is made through this screen with the tube 36 in. above the plate, there will be projected on that plate a series of parallel lines which will be slightly more than 1 cm. apart but will nevertheless represent the distance of 1 cm. in the plane of the lead strips above. If this procedure is carried out at different levels, beginning 9 cm. above the plate and continuing at centimeter intervals up to 19 cm., there will be a series of exposed plates with parallel lines. The distance between two of these lines in any given plate will represent a distance of 1 cm. in the corresponding plane above.

In order to apply this method of scaling to the superior strait, it is necessary to determine the distance of the superior strait above the sensitive plate and then to place the notched strip which corresponds to this distance directly on the sensitive plate. With the patient in position, the back arched, and the superior strait made parallel with the plate, the distance of the superior strait above the plate is measured with ordinary calipers. If, for instance, this distance is 12 cm., lead strip No. 12 is used for scaling the slightly enlarged shadow that will result from the exposure. The exposure having been made with the patient in position, the development of the plate results in a slightly enlarged outline of the superior strait and on the edge of the plate a scale formed by the notches in the lead strip. By means of calipers, any diameter of the superior strait may be measured directly on the film, the distance being read on the scale at the edge of the film.

Duplitized superspeed films, a double screen with a Bucky diaphragm, and a medium-focus Coolidge tube are used. The target plate distance is 36 in. A point spark gap distance of 7 in. is employed, which is equivalent to approximately 65 kilovolts. The amount of current is 20 ma. By using a milliampere meter in filament circuit, this voltage can be readily obtained without passing the current through the tube. The time varies between ten and thirty seconds, depending upon whether the patient is pregnant and upon her stature.

ROLAND S. CRON, M.D.

Williams, J. W.: Further Observations Concerning Premature Separation of the Normally Implanted Placenta. *J. Obst. & Gynæc. Brit. Emp.*, 1925, xxxii, 259.

This article is based upon the report of a fatal case of separation of the normally implanted placenta with concealed hæmorrhage. At operation the uterus was removed unopened, but the patient succumbed. At autopsy it was clearly demonstrated that the amount of blood lost was insufficient to account for the symptoms of shock, but no toxæmic lesions could be found. The decidua basalis had been disorganized by hæmorrhage which involved the adjacent musculature. In general, the uterine musculature was normal except that, especially in the outer layers, it was spread apart by small collections of blood of apparently venous origin. Œdema and infiltration by clasmatocytes were also observed. There was no trace of degenerative change or decidual inflammation.

In 9,000 consecutive cases admitted to the obstetrical service there were fifty-seven cases of premature separation of the placenta and sixty-four cases of placenta prævia. In primiparæ, premature separation of the placenta is more common than placenta prævia. In the author's series of forty cases there were nineteen mild cases with external bleeding, sixteen severe cases with combined external and internal bleeding, and five severe cases

with entirely concealed bleeding. Seventeen cases terminated spontaneously and twenty-three required operative intervention. In ten of the latter a cæsarean section was done. The gross maternal mortality was 7.5 per cent and the gross infantile mortality 72.5 per cent. The author reports a case in which the condition occurred in two successive pregnancies.

In most of the severe cases the condition is associated with the "uteroplacental apoplexy" of Couvelaire. Ligneous consistency of the uterus is noted in about every third case. When present, this is a pathognomonic sign, but its absence is not equally valuable negative evidence.

In many of the severe cases, pre-eclamptic toxæmia, eclampsia, chronic nephritis, or "essential hypertension" precedes or accompanies the accident, but in the cases of fifteen of the twenty-seven patients who survived delivery, albuminuria was entirely absent during the puerperium. If some of the severe cases are the result of toxæmia, it must be admitted that its origin and mode of action are unknown. Evidence is adduced which indicates that traumatism, syphilis, inflammation of the decidua, shortness of the umbilical cord, and torsion of the pregnant uterus are rarely if ever concerned in the production of the condition.

The article is concluded with an abstract of the clinical records of the five cases of entirely concealed hæmorrhage and the ten cases treated by cæsarean section. GOODRICH C. SCHAUFFLER, M.D.

Burgess, H. C.: Hæmorrhage in the Last Trimester of Pregnancy. *Am. J. Obst. & Gynec.*, 1925, x, 49.

In 18,720 cases of delivery accidental hæmorrhage occurred in eighty. In seventy-six the hæmorrhage was of the apparent type and in four of the concealed type. In each group of cases there were three maternal deaths.

The factors leading up to these hæmorrhages are usually unascertainable, but in sixteen there was a definite history of toxæmia manifested by œdema, albuminuria, elevation of the blood pressure, etc. This toxæmia was present as a predisposing factor in all fatal cases.

The accepted treatment of concealed antepartum hæmorrhage is immediate delivery, usually by the abdominal route. As the mortality is between 50 and 60 per cent, Burgess believes this is not justified. The patient suffering from concealed hæmorrhage is usually weakened from the loss of blood and in a state of shock from the crushing pain of the forcible distention of a hollow viscus. In addition, there is usually marked toxæmia. The author doubts whether there is any other condition in which a major operation would be undertaken under such adverse circumstances.

Apparent accidental hæmorrhage occurred in seventy-six of the cases reviewed. In seventy-one of these, spontaneous delivery occurred. In one case the patient was delivered with forceps; in another, version was done; and in a third, an abdominal hysterectomy was performed. Two patients were not delivered. Of the three women who died, one died of sepsis, one was admitted to the hospital *in extremis* and died undelivered, and one died six hours after version and extraction and manual removal of the placenta.

Placenta prævia occurred in 148 patients (0.78 per cent). In thirty-one cases it was of the central variety; in fifty-three, of the lateral variety; and in sixty-four, of the marginal variety. In the cases of fifty-two patients who delivered themselves normally or aided by artificial rupture of the membranes, there were twenty-two infantile deaths and one maternal death. An accouchement forcé followed by version and extraction was done in sixteen cases with four maternal deaths. In twenty-one cases in which Braxton-Hicks version was performed (in practically all, in the period from 1906 to 1912) there were no maternal deaths but seventeen of the infants died. In later years this operation was supplanted by the use of the hydrostatic bag. In sixteen cases in which the hydrostatic bag was used there were no maternal deaths and the fetal mortality was much lower. Cæsarean section gives far better results than forcible dilatation of the cervix, but in twelve cases in which cæsarean section was performed two mothers and four babies died.

Postnatal hæmorrhage occurred in sixty cases. This results from partial separation of the placenta, retained cotyledon, atony of the uterus, or laceration of the birth canal. An exact diagnosis is necessary for proper treatment. The nature of the condition can usually be ascertained from the time the bleeding begins and the type of the bleeding. Twenty-one cases of postpartum hæmorrhage were due to partial separation of the placenta, thirty-eight to atony of the uterus, and one to laceration of the birth canal. Thirty-eight of the patients were primiparæ and one was a multipara. One mother died. Manual removal of the placenta for other causes than bleeding was necessary in twenty-four cases. In these cases, there were no maternal deaths.

E. L. CORNELL, M.D.

Wetterdal, P.: Fixation of the Fetal Head During the Latter Part of Pregnancy: A Comparison Between Primiparæ and Multiparæ. *Acta gynec. Scand.*, 1925, iii, 297.

Mobility of the fetal head during the last month of pregnancy in a primipara does not necessarily denote a pathological condition, as was formerly believed. The author has found the head movable in 47 per cent of his normal cases. The incidence of fixation of the head in the latter part of pregnancy does not vary greatly between primiparæ and multiparæ, but when labor pains begin, the head becomes fixed much oftener in the former than in the latter. This fact is evidently due to the difference in the condition of the lower uterine segment. Tonicity of the abdominal wall and the quantity of liquor amnii do not seem to play a part in the fixation except in extreme cases.

Doub, H. P.: Obstetrical Roentgenology, with Special Reference to Anencephaly. *Am. J. Roentgenol.*, 1925, xiv, 39.

The development of obstetrical roentgenology has been retarded by the lack of physical instruments necessary for rapid exposures and brilliant roentgenograms and by the fear of causing damage to the developing fetus.

There are many schools and hospitals that have made routine X-ray plates of every suspectedly abnormal pregnancy. From the standpoint of the student, as well as the patient, such examinations will be of inestimable value.

The following conditions may be revealed first by the X-ray: anencephaly, fetal death, hydrocephalus, abdominal pregnancy, multiple pregnancy, malformations of the fetal skeleton, changes found by pelvimetry, and changes evident in pneumoperitoneum.

HARVEY B. MATTHEWS, M.D.

Kretschmer, H. L., and Heaney, N. S.: Dilatation of the Ureter and Kidney Pelvis During Pregnancy: A Pyelographic Study. *J. Am. M. Ass.*, 1925, lxxxv, 406.

Repeated pyelography during the course of pregnancy shows the progress of pathological changes. In several of the authors' cases in which such examinations were made early in pregnancy, a certain amount of dilatation was found in the higher urinary tract, but pyelograms made several weeks later showed that the kidney was lying at its normal level and that the dilatation had disappeared at least temporarily.

In other cases the dilatation present early in the pregnancy increased and the hydronephrosis became more marked. In some of the cases there was definite displacement of both ureters away from the median line so that the distance between them was greatly increased. This displacement was noticed particularly when the dilatation of the ureters was extensive.

In some of the cases the dilatation extended all the way up the ureter from the bladder to the kidney pelvis and was extreme. In others, it seemed to come to a very abrupt stop at about the brim of the pelvis and below this point the ureters were dilated only slightly or were normal. This was noted particularly in cases showing lateral displacement of the ureter.

Several patients complained of obscure, indefinite, and atypical abdominal pain during pregnancy. In two instances a diagnosis of possible appendicitis had been made. There was no elevation of the temperature and there were no abnormal urinary findings. Pyelographic examination revealed dilatation and kinking of the ureters and hydronephrosis. Dilatation of the ureter and kidney pelvis during pregnancy often causes pain in the sides and upper abdomen, but the urinary tract is not suspected to be the cause of the pain because there is no fever and the urine does not contain pus.

E. L. CORNELL, M.D.

Horn, W. S.: Fetal Protein Intoxication—the Fundamental Factor in the Vomiting of Pregnancy—A Preliminary Report. *Texas State J. M.*, 1925, xxi, 180.

The author is not satisfied with the old etiological classification of vomiting into the reflex, neurotic, and toxæmic types. He remains unconvinced of the occurrence of reflex vomiting, and states that toxins and glandular dysfunction have not been established as causes and that the variety of treatments now in vogue indicates the existing confusion. With Udeata, he believes that the vomiting of pregnancy is the result of intoxication caused by the products of gestation. He assumes that the fetus acquires the father's characteristic albumin within the mother and that this is responsible for the intoxication of pregnancy.

Repeating Udeata's work, Horn injected graduated amounts of the father's blood in eight cases. In these eight cases and in a series of forty cases studied postnatally, the types of the mother and child differed, that of the child being in nearly constant agreement with that of the father. When in the untreated cases the type of the child did not agree with that of the father, the treatment was less efficacious. Twenty-five cases in which there was no vomiting showed agreement between the mother and child.

The symptoms produced by injection of blood of one group into a person belonging to another group are very similar to those occurring in the vomiting of pregnancy but are more acute and severe. Pathological changes such as central necrosis in the liver lobules and degeneration of the renal tubules are almost identical with the hæmolytic reactions following transfusion. The severity of the symptoms agrees roughly with the recognized degrees of incompatibility of the blood groups involved. The fact that the blood of the fetus may be of a type different from that of the blood of the mother is explained by Buchanan's theory that identical blood groups, mated in the heterozygous state, will give rise to groups resembling those of the grandparents. In any case, it seems agreed that the hereditary transmission of blood groups follows closely the mendelian formula for dihybrid matings.

The transmission of toxic substances from the child to the mother and the favorable effect of injections of the father's blood are not understood. The suggestion is made that practically all of the disturbances of pregnancy, including those of the fetus, may have a similar etiological basis. The treatment should be governed by the established facts regarding the compatibility of blood groups.

GOODRICH C. SCHAUFFLER, M.D.

Cary, E.: The Etiology of Pre-Eclamptic Toxæmia from a Clinical Aspect. *Surg., Gynec. & Obst.*, 1925, xli, 194.

The author formulated the following hypotheses and attempted to prove them from the clinical standpoint:

1. The syndrome known as eclampsia is probably due to a toxic substance.
2. This toxic substance is probably an early split product of the protein molecule.
3. The source of the toxin is not single.
4. The toxin enters the maternal circulation as the result of the autolysis of degenerating placenta and the absorption of split products of bacterial origin, through the large intestine, and from primary foci of infection.
5. The maternal circulation is so overwhelmed by these byproducts that its power to neutralize them is diminished and they produce the injurious effects which result in the syndrome of eclampsia.

By extracting with normal salt solution placental tissues free from blood which had been incubated for an hour, Cary was able to obtain a substance which was toxic to guinea pigs when given intraperitoneally in doses of 2 c.cm.

This substance was quickly absorbed into the circulation of the guinea pig and seemed to be soon neutralized.

If the extract was incubated with one-third its volume of pregnant horse serum (globulin) for one hour, its toxicity was destroyed.

Cary concludes that these facts are rather striking evidence that a substance is elaborated by autolysis in the normal placenta which in laboratory animals will cause symptoms resembling those of eclampsia. ROLAND S. CRON, M.D.

Titus, P.: Hyperemesis Gravidarum. *J. Am. M. Ass.*, 1925, lxxxv, 488.

Intravenous injection of glucose for hyperemesis gravidarum, first recommended in two previous communications by the author and his co-workers, is now an accepted method of treatment.

The therapeutic dose of glucose for an adult of average size is from 50 to 75 gm. Smaller doses do not give the desired effect. Preparations of glucose for intravenous administration must be chemically pure because reactions are usually traceable to impure or carelessly prepared solutions. Hypertonic solutions (preferably 25 per cent) act more promptly and favorably than weak solutions. Single injections are safer than a continuous flow, but must be repeated from one to three times daily according to the patient's condition and response.

In a series of 328 cases of hyperemesis gravidarum, treatment by high carbohydrate feedings or intravenous injections of glucose gave favorable results. In four cases in which a therapeutic abortion was performed there were three deaths. Two of these cases were classed clinically as acute yellow atrophy of the liver.

The treatment of hyperemesis gravidarum by glucose and other carbohydrates given by vein, by mouth, or by bowel is based on the assumption that there is a carbohydrate deficiency in the maternal organism.

This deficiency occurs as the result of an unusual demand for carbohydrates made by the growing fetus and a diminished carbohydrate intake in the patient's diet, being therefore a combination of an indirect and a direct starvation.

Pregnancy toxæmia and starvation are not identical. Every pregnant woman is a potential subject for toxæmia, and if the liver is depleted of its reserve glycogen by carbohydrate starvation its detoxicating action is thereby impaired and a more profound effect from toxins is thus made possible.

Carbohydrate deficiency in pregnancy toxæmia is probably the cause of part of the central necrosis of the liver lobules seen in fatal cases, its action being the same as that by which simple starvation produces similar necrosis.

The action of glucose is probably twofold: (1) a direct liver-sparing effect, and (2) a stimulation of the storage powers of the liver cells, which is practically identical with regeneration and repair.

Ampoules of concentrated glucose solution which may be diluted as required are now being prepared by reliable pharmaceutical firms and may be obtained for emergency use or when laboratory facilities are not available.

A limited but fairly comprehensive experience with the combined use of insulin and glucose injected intravenously has led to the belief that this is of no clinical advantage. Moreover, there is evidence to show that insulin causes the depletion of glycogen stores by its demand for glucose to be oxidized and otherwise metabolized. Therefore in the toxæmia of pregnancy in which storage in the liver and not combustion of the injected sugar is the desired result, the simultaneous administration of insulin is contra-indicated.

ROLAND S. CRON, M.D.

LABOR AND ITS COMPLICATIONS

McCullagh, W. McK. H.: Inversion of the Uterus: A Report on Three Cases and an Analysis of 233 Recently Recorded Cases. *J. Obst. & Gynæc. Brit. Emp.*, 1925, xxxii, 280.

Cases of inversion of the uterus are classified as acute cases, chronic cases, cases due to tumor, and idiopathic cases. Of the series reviewed by the author, 85 per cent were of puerperal origin.

The average incidence of acute inversion is 1 in every 30,000 labors. Fifty per cent of the women affected are primiparæ, but age is of no etiological importance as the inversion usually occurs at the first labor. In over 66 per cent of the cases it occurs with the delivery of the placenta, and in the remaining 44 per cent with the delivery of the child, or hours or days after the delivery of the placenta. In two of the cases reviewed it recurred in a subsequent confinement.

Uterine inertia is a constant accompaniment. Almost all inversions are subtotal. In 13 per cent of the cases the inversion appears to be spontaneous. The most common cause is injury from pressure applied from above, as in an improper Crédé expression of the placenta, or from traction from below, as

by a short cord, manual removal of the placenta, funic traction, or a combination of pressure from above and traction from below.

In the majority of cases the subjective symptoms are mild and reduction can be accomplished without the patient's knowledge. Pain and shock are caused when the ovaries are crushed together in the sac of the inverted fundus and, like hæmorrhage, occur in fewer than 50 per cent of the cases. In some cases the symptoms of sepsis may supervene.

The diagnosis should not be difficult. Rectal examination is of particular aid as the ring of the cervix is always palpable. Such diagnoses as "bleeding tumor," "false conception," and "the head of the second child" have cost the life of the patient.

In acute cases without shock, reduction by the peripheral taxis of Emmet should be performed at once. Pituitrin and ergot should be given with the hand still in the re-inverted uterus, and their administration should be followed by hot intra-uterine douches. Hæmorrhage must be controlled and shock alleviated before any manipulation is undertaken. Packing of the vagina may be advisable.

In the cases reviewed in which shock was present the mortality was 30 per cent, while in those without shock it was only 5 per cent. When there is evidence of sepsis it is best to wait two weeks before attempting reduction with Aveling's repositor. Cutting operations are inadvisable at this stage. The gross mortality of acute inversion is not more than 25 per cent.

In 18 per cent of the cases reviewed the condition was chronic, having been present longer than eight weeks. Attempts at manual reduction usually fail. The treatment of choice is the method of Aveling. If this procedure fails, operation may be indicated. The Kehrer-Spinelli-Oui anterior colpohysterotomy gives free access and good drainage. Hysterectomy on women under 40 years of age amounts to an admission of failure by the surgeon. The mortality of chronic uterine inversion is that of its operative treatment, 6 per cent.

The author reports two acute cases and one chronic case which were successfully treated by the methods he advocates.

Tumor inversion is due to the weight of the growth and the efforts of the uterus to expel it. In 95 per cent of such cases the causative tumor is a fibroid (Thorne). Sepsis is usually present. It is important to exclude malignancy. The most successful routine treatment consists in vaginal douches for a week, followed by removal of the tumor. Enucleation is the method of choice. After another week of douches reduction can probably be accomplished safely by the method of Aveling. The mortality of inversion due to tumor and its treatment is 8.5 per cent.

GOODRICH C. SCHAUFFLER, M.D.

GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Marion, G.: The Present Lack of Knowledge Regarding the Recognition and Treatment of Perinephritic Abscess (On connaît mal le phlegmon périnéphritique; comment le reconnaître et comment le traiter). *J. d'urol. méd. et chir.*, 1925, xix, 140.

Marion discusses the special features of perinephritic abscess, the significant history, the often misunderstood symptoms, and the treatment. Several illustrative cases are cited.

The symptoms and signs most often described as typical are swelling, œdema, and hyperæmia in the lumbar region, pain, and fever. This is the picture of the acute form which is seen only exceptionally; before its development many patients are allowed to go for long periods of time without treatment.

As a rule the patient suffers intensely, at least in the beginning, from pain which is most acute in the costovertebral angle and hypochondrium just external to the rectus. Occasionally, invasion of the psoas muscle renders extension of the thigh difficult. There is usually a quite high and oscillating fever, but in chronic cases fever may be entirely absent.

The physical signs consist in rigidity and resistance in the lumbar region which in some cases is very extensive and in others is limited to the costovertebral angle. Occasionally bimanual palpation reveals a mass in the renal fossa. The X-ray examination is unnecessary for a diagnosis and is often negative. The urine is usually normal.

The condition may have an acute and progressive course, but frequently develops slowly with acute exacerbations and remissions. Often it is characterized only by occasional attacks of fever and pain. During the remissions slight tenderness and rigidity are noted in the flank.

Very important to the diagnosis is the history which nearly always reveals previous suppuration, furunculosis, panaris, or an injury to the lumbar region.

In all forms of perinephritic abscess there is a marked and rapid decline in the general condition.

The treatment is always operative and must be undertaken as soon as it is evident that the inflammation will not resolve of itself. In the acute forms, pus is almost always found by the twelfth day. Drainage should be established through a reduced nephrectomy incision. It is best not to expose the kidney. Care must be taken to open all of the pockets. To prevent a recurrence the tube must be left in place over an extended period. Persistent fever and pain following the operation indicate an undrained focus or a pyonephrosis. If the symptoms do not abate after a reasonable length of time the kidney fossa must be explored; possibly a nephrectomy may be necessary. In the chronic types the suppuration may be minimal and the abscess very difficult to find in the mass of indurated tissue.

ALBERT F. DEGROAT, M.D.

Levy, R., and Negro, M.: The Sensitivity of the Phenolsulphonephthalein Test for Renal Function (La sensibilité de l'épreuve de la phenolsulphonephthalein pour l'exploration fonctionelle des reins). *J. d'urol. méd. et chir.*, 1925, xix, 208.

Because of the increased use of the phenolsulphonephthalein test by French urologists the authors attempted to determine the rules governing the elimination of the dye and compared the results with those of Ambard's constant.

It was found that to obtain constant results the dye must be administered intravenously. A normal person eliminates 50 per cent (1 c.cm. of a 0.6 per cent solution) in an hour and ten minutes. An elimination of as much as 65 per cent was observed by the authors in only one case—that of a patient with amyloidosis. In prostatic conditions, operation can be performed safely when there is an elimination of 45 per cent if other factors are equal and 5 per cent is allowed for loss through the cystostomy wound.

The elimination is profoundly influenced by circulatory disturbances. Cardiac decompensation may reduce the phenolsulphonephthalein excretion to nil even when the kidneys are sufficiently intact to maintain life for a long time and to preserve a normal blood urea content. Hypertension frequently lowers the elimination of phenolsulphonephthalein, but does not always do so.

In cases of permanent hypertension the degree of renal sclerosis must be considered. The authors are convinced that there are many cases of permanent hypertension which is quite independent of a kidney lesion. Many patients with evident renal lesions have excellent elimination following suprapubic drainage. The blood pressure is lowered correspondingly. In other cases, after a period of improvement, the condition remains stationary with an elimination somewhat below normal and a permanent hypertension which is resistant to all treatment. In many of the latter, operation is well borne and the condition is probably an essential hypertension, the circulatory disturbance alone accounting for the low elimination. Therefore in this group an elimination of 40 per cent is regarded as the limit of safety.

Experience has shown that hypotension (below 110/60) is an unfavorable sign, and that a normal elimination of phenolsulphonephthalein does not guarantee against postoperative disaster.

Ambard's constant and the phenolsulphonephthalein elimination have often been found at variance. A large number of successful operations have demonstrated the greater reliability of the latter method. The relative inaccuracy of the constant has often been so striking that doubts have been raised as to its practicability and even its theoretical basis.

In the separate study of the kidneys the phenolsulphonephthalein test has proved especially accurate. It affords a means of recognizing polycystic disease which hitherto has frequently escaped all methods of examination. The sum of the amounts of phenolsulphonephthalein in the separated urines should approximate the normal. Any deficit must be attributed to an error in technique or a medical or toxic nephritis of the supposedly intact kidney. The elimination of phenolsulphonephthalein is dependent entirely upon the condition of the renal parenchyma and is uninfluenced by polyuria or the other factors which so frequently falsify the indications furnished by the urinary urea and urinary chlorides.

Early renal tuberculosis modifies the elimination of phenolsulphonephthalein long before it causes other definite urinary signs.

ALBERT F. DEGROAT, M.D.

Kammerer, F.: An Unusual Experience with Nephrectomy for Suppurative Nephritis. *Surg., Gynec. & Obst.*, 1925, xli, 70.

Suppurative nephritis occurs more frequently in the right kidney than in the left and is more common in females than in males. Lesions of the kidney which may be followed by hæmatogenous infection may be produced by violent contractions of the abdominal and back muscles.

In the case of a 62-year-old woman the muscular exertion of trying to prevent a fall was followed by severe pain in the left kidney. After the patient had remained in bed for five days her temperature was 103.5 degrees F., her pulse was 110, she showed signs of septic toxæmia with distention, the region of the left kidney was very tender, and the urine contained a large quantity of pus.

Eight days after the accident the kidney was exposed by lumbar incision and the cortex stripped. The kidney was then removed as the cortex was found densely studded with miliary abscesses. Thereafter the temperature dropped from 104.4 to 97.6 degrees F., but then rose to 99 degrees. On the eighth day the patient died from renal insufficiency.

Autopsy revealed suppurative nephritis on both sides. Pure cultures of bacillus coli communis were obtained from both kidneys. The pathological changes in the left kidney were further advanced at the time of the nephrectomy than those of the right kidney at the time of death a week later. The author suggests that the removal of the left kidney may have acted as trauma favoring the retention of bacteria circulating in the blood, thus being responsible for the infection of the other side. He believes that recovery might have followed decapsulation or nephrotomy, and that therefore it is generally wiser to give conservative treatment consisting in early exploratory operation with decapsulation. Nephrectomy should be added only if symptoms of septic intoxication persist.

BENJAMIN F. ROLLER, M.D.

Fletcher, E. A., Kearns, W. M., and Liebeler, W. A.: Ureteral Stricture. *Wisconsin M. J.*, 1925, xxiv, 66.

Up to 1910 most ureteral strictures were thought to be congenital and a diagnosis was seldom made before operation or autopsy. Such strictures are manifested only by the complications they produce. Desnos in 1913 stated that ureteral strictures are generally due to the passage of a stone. Hunter, who reported fifty cases of acquired ureteral stricture in 1915 and nearly 2,000 since then, says that in such cases there is generally a focus of infection outside the urinary tract, that the strictures are always bilateral, usually single, and as a rule are situated in the lower third of the ureter.

Of 338 patients examined by the authors, a ureteral stricture was found in thirty-one (9 per cent). All had demonstrable foci of infection, and in most of them these foci were in the teeth.

The most common symptom is pain deep in the pelvis, and the next most common, pain in the kidney which sometimes requires morphine for its relief. Other symptoms are frequency, hæmaturia, anorrhexia, flatulence, and a low-grade fever.

A severe reaction immediately following ureteral catheterization is characteristic of stricture because the swelling incident to the instrumentation brings about obstruction. Ureteropyelograms are made with 15 per cent sodium iodide.

The treatment of ureteral stricture includes the removal of foci of infection, dilatation of the stricture, and sometimes operation for stone and advanced kidney disease. Dilatation is done through the cystoscope and by passing an instrument from the kidney to the bladder at the time of operation on the kidney. A bougie may be left in for from two to ten minutes and a catheter for from two to twenty-four hours, and this may be repeated every ten days, on one side at a time. The dilatation is complete when a No. 16 Garceau catheter can be passed.

BENJAMIN F. ROLLER, M.D.

Goldstein, A. E.: A Study of Urinary Stasis in Ureteral Obstructions. *J. Urol.*, 1925, xiv, 33.

Ureteral obstruction may be divided into two general types—that due to extrinsic causes such as pregnancy and ureteral kinks, and that due to intrinsic causes such as ureteral strictures, stones, and tumors. The result is stasis, whatever the cause.

The degree of stasis is measured by time. The capacity of the kidney pelvis is determined by injecting sterile water to the point of fullness or pain. A ureteropyelogram is then made and the catheter

is withdrawn. Plates are made at first at intervals of seven or eight minutes and then every fifteen minutes.

The normal length of time in which the solution is expelled ranges from three to seven minutes. Plates which show the presence of the solution longer than the normal length of time demonstrate stasis. Six of twenty-four pathological cases are cited to show the importance of determining stasis.

CLAUDE D. PICKRELL, M.D.

Carson, W. J.: Metastatic Carcinoma of the Ureter Associated with Ureteral Stricture. *Ann. Surg.*, 1925, lxxxii, 142.

Carson states that the ureters usually escape invasion of carcinoma cells from the uterus, prostate, and bladder by way of the lymphatics, but may become involved in extension of the malignant process by continuity. In the literature he was able to find only two cases of metastasis to the ureter through the lymph or blood stream. To these he adds three more. In one, the primary neoplasm was in the bladder; in the second, in the prostate; and in the third, in the uterine cervix. In every case, cancer cells were found in the perivascular spaces of the ureter and ureteral strictures of inflammatory origin were found.

BENJAMIN F. ROLLER, M.D.

BLADDER, URETHRA, AND PENIS

Graves, R. C., and Davidoff, L. M.: Studies on the Bladder and Ureters, with Special Reference to Regurgitation of the Vesical Contents; Regurgitation as Observed in Cats and Dogs. *J. Urol.*, 1925, xiv, 1.

In experiments on rabbits reflux of the contents of the bladder occurred in 80 per cent. This reflux depended upon intravesical pressure engendered and sustained by active tonic contraction of the bladder musculature as it resisted distention.

In a series of eight experiments on cats the entire urinary tract was exposed through a midline incision.

The cat was then catheterized and the bladder filled by gravity with colored warm physiological salt solution. The bladder pressure was recorded by a mercury manometer. The average quantity of salt solution used was 134 c.cm., and the average intravesical pressure developed was 64.7 mm. Hg. Regurgitation was observed in five of the experiments. At the time of the reflux the average bladder content was 132 c.cm. and the average pressure 47.6 mm. Hg.

In the cat, the reaction of the bladder to distention was the same as in the rabbit. At first there was no resistance, but later there was a rather abrupt and vigorous contraction which raised the intravesical pressure. It was during the latter phase that regurgitation occurred.

In experiments on thirty-three dogs the average quantity of salt solution used was 521 c.cm. and the average intravesical pressure developed was 87 mm. Hg. Reflux occurred in nine of the dogs, and in seven was bilateral. The average bladder content at the time of the regurgitation was 488 c.cm., and the average pressure was 85 mm. Hg. The authors explain the lower incidence of reflux in dogs by the fact that in this animal the tonic contractions of the bladder muscles are not sustained. The dog's bladder is of the passive type.

In a series of experiments carried out on ten dogs to determine whether an increase of the irritability of the bladder would increase the incidence of reflux, sterile stones were placed in the bladder by suprapubic operation. Reflux occurred in four cases.

The average quantity of salt solution used was 270 c.cm., and the pressure was 99 mm. Hg. The average amount of salt solution in the bladder at the time of the reflux was 212 c.cm., and the average pressure 85 mm. Hg. This group of animals therefore reacted similarly to the cats and rabbits.

In two dogs in which the ureters were transplanted into other parts of the bladder so that they were oblique to the bladder wall, and in two in which they were transplanted at a right angle to the bladder wall it was found that reflux occurred in the latter when the intravesical contents equalled 250 c.cm. whereas in the former it did not occur even when the intravesical contents reached 850 c.cm.

In conclusion the authors state that the valve-like arrangement of the ureter is an insufficient protection against ascending infection, and that the degree of ureteral activity has little to do with regurgitation of the contents of the bladder.

CLAUDE D. PICKRELL, M.D.

Farr, R. E., and Brunkow, C. W.: Hernia of the Bladder. *Ann. Surg.*, 1925, lxxxii, 264.

The authors review the literature on hernia of the bladder and report a case.

Bladder herniæ are rare. They are supposed to be due to a congenital or acquired weakness of the abdominal wall. They may be inguinal or femoral. The latter type usually occurs in women. Most bladder herniæ are false, being without a peritoneal sac.

Usually there is bulging in the inguinal canal which decreases or disappears when the patient lies down or empties his bladder. The simplest and surest way of arriving at a diagnosis of bladder hernia is cystographic examination with the bladder distended with air or sodium iodide as was done in the case reported by the authors.

The treatment is surgical. If the bladder hernia is complicated by an intestinal or omental hernia the latter should be repaired in the usual way and the bulging portion of the bladder pushed back into place behind the repaired abdominal wall. If the bladder hernia is complicated by diverticula elsewhere in the bladder or by calculi, a suprapubic incision may be necessary.

HENRY L. SANFORD, M.D.

Cairns, H. W. B.: Observations on the Etiology and Treatment of Cystitis. *Brit. J. Surg.*, 1925, xiii, 78.

This article reports a study of eighty-six cases of cystitis with reference to their causes and treatment. Cases due to tuberculosis, chemical irritants, and purpura were excluded. Cairns believes that the normal bladder is extremely resistant to bacterial and instrumental infection.

The cases reviewed are divided into two groups—the simple or resolving type of cystitis which tended to become cured promptly under treatment by very simple measures, and the chronic or progressive type due to persistent kidney infection or obstruction to drainage. In the chronic type the treatment consists in correction of the cause.

H. L. Sanford, M.D.

King, E. H.: Ulcers of the Bladder. *California & West. Med.*, 1925, xxiii, 1030.

Most of the bladder ulcers King has seen have been of gonorrhœal origin. The symptoms were severe pain and bloody, turbid urine. The lesions were slow to respond to treatment unless they were fulgurated. Most of the patients refused fulguration.

As astonishing results have been obtained from the administration of parathyroid substance in cases of varicose ulcers of the leg and ulcers of the rectum, King tried it with calcium lactate for ulcer of the bladder. In the three cases treated in this manner the results were gratifying. Louis Gross, M.D.

Ward, R. O.: A Clinical Study of Eleven Cases of Vesical Diverticula. *Brit. J. Surg.*, 1925, xiii, 144.

Vesical diverticula may be congenital. They become large enough to produce symptoms as the result of obstruction. The most common symptoms result from infection of the stagnant urine in the pouch. A correct diagnosis may be made by means of the cystoscope and cystogram. Excision is necessary for a cure. When obstruction is present, it also requires operation as a rule.

Samuel Kahn, M.D.

Martin: The Probable Stimulation in the Rate of Growth of a Cancer of the Bladder by Deep X-ray Therapy (Accélération probable de la marche d'un cancer de la vessie sous l'influence de la radiothérapie ultra-pénétrante). *J. d'urol. méd. et chir.*, 1925, xix, 232.

There have been reported in France several apparent cures of cancer of the bladder by deep X-ray treatment. The author states that he has never seen such a cure and in this article reports a case in which it appeared that the growth of the tumor was stimulated by the treatment.

At the first examination an ulcer the size of a dime was found in the fundus of the bladder. For four months the patient had had intermittent hæmaturia and dysuria. As the bladder distended well and the general health was unaffected, operation was refused.

The patient was then treated by an experienced radiologist. After a brief period of symptomatic improvement and slight recession of the ulcer, the bladder symptoms became extremely severe and the general condition rapidly declined. Eventually cystostomy became necessary. Death occurred at the end of a year. The tumor removed at autopsy had histological characteristics of an extremely malignant type.

While it is recognized that the course of tumors is most variable, it is rare for a carcinoma with such a clinical picture to cause death so quickly. As this case was especially favorable for operation, it is reported as a reply to radiologists who frequently reproach surgeons for not resorting to X-ray treatment from the beginning in all cases.

Albert F. DeGroat, M.D.

Richter, S.: Tuberculosis of the Urethra, with Particular Reference to the Stricture Forming Type (Zur Kenntnis der Harnroehrentuberkulose, insbesondere ihrer strikturierenden Form). *Acta chirurg. Scand.*, 1925, lix, 237.

Richter reports two cases of tuberculous stricture of the urethra in which dilatation of the urethra with sounds was followed by miliary tuberculosis, causing death within a short time. He reports also a case of tuberculous periurethritis with secondary infection, miliary tuberculosis, and sepsis. In this case it is possible that there may have been a primary tuberculosis of the urethra or the seminal vesicles.

As in some instances even severe tuberculous strictures of the urethra do not cause any subjective symptoms whatever, the possible presence of such a stricture should be considered in all cases of tuberculosis of the urogenital tract.

The author warns against the sounding of strictures in urogenital tuberculosis when there may be reason to suspect that the stricture is due to the tuberculosis.

In these cases exploratory exposure of the kidneys or ureters is recommended instead of cystoscopic examination. In nine of thirteen cases of urogenital tuberculosis with urethral stricture which were seen by Richter, it was possible to remove the primary focus by nephrectomy, and in eight of these nine cases the operation was followed by healing of the urethral tuberculosis.

Huddy, G. P. B.: Urethral Pouches. *Brit. J. Surg.*, 1925, xiii, 50.

This article deals with urethral pouches in the male and begins with a review of the anatomy and embryology of the male urethra.

In some cases urethral pouches are congenital. In others they are acquired as the result of dilatation of the urethra by calculi, the occurrence of stricture or perforation of the urethra from injury or the rupture of abscesses or cysts. They range in size from minute dilatations of normal glands to dilatations the size of coconuts. Those causing symptoms are usually as large as walnuts.

Stasis, infection, and stone formation may occur within the pouch. Pouches are often not recognized because they may produce only few and unimportant symptoms.

Congenital pouches are much rarer than acquired pouches and usually occur in the penile portion of the spongy urethra. Acquired pouches may result from dilatation of the glands and lacunæ behind an obstruction of the urethra. They may be formed also by the development of a periurethral abscess behind a stricture. Injury may cause pouches in both males and females.

Clinically the cases may be divided into two groups—those with indefinite symptoms, in which the diagnosis can be made only by means of the urethroscope, and those with swelling at some point along the urethra. A case illustrative of each type is cited. The symptoms may be modified by complications such as inflammation and the formation of stones. LEO M. ZIMMERMAN, M.D.

GENITAL ORGANS

Player, L. P.: The Prostate and Its Influence on Low Back Pain. *California & West. Med.*, 1925, xxiii, 993.

Player reviews his findings and treatment in 100 prostatic cases. He says that frequently in these cases, when urological symptoms are uppermost and backache is less prominent, the urologist sees the patient in consultation with the family physician or the orthopedic surgeon who is endeavoring to discover a focus of infection for sacro-iliac or lumbosacral joint inflammation.

A search for foci in the sinuses, teeth, and tonsils is very important because unless all possible foci are treated as well as the prostatitis, improvement is slow and recurrence the rule.

In the absence of foci elsewhere, the result of the treatment of prostatitis and its influence on the back pain is gratifying, but usually patience is essential on the part of both the surgeon and the patient. Gradual improvement without recurrence of pain is not the rule.

In the study of the secretion it is often necessary to massage the prostate and strip the vesicles from one to four times on consecutive days.

Player summarizes his article as follows:

1. Until recently, pain in the back was attributed entirely to static conditions, muscle or ligament strain, and nerve involvement except in cases of arthritis.

2. Rosenow and his followers have shown that bacteria from foci of infection have a selective action and that the different types produce myositis, myalgia, synovitis, and arthritis.

3. Eradication of focal infection in the prostate and seminal vesicles as well as in the tonsils, teeth, adenoids, and appendix will cure myalgia, myositis, synovitis, and neuritis.

4. In prostatitis there are organisms analogous to those found by Rosenow in other foci.

5. In about 25 per cent of cases of backache associated with prostatitis orthopedic surgeons find X-ray lesions of the pelvic joints.

6. The proper treatment of prostatitis requires a complete history and a careful diagnosis.

7. In the treatment of prostatitis all contiguous organs must be carefully looked after in order that all possible foci of infection may be eradicated.

8. Prostatitis is one of the most important causes of backache. Routine examination of the prostate should be made in the cases of all male patients complaining of backache.

9. As there is no specific cure for chronic prostatitis, and as it takes from months to years of careful treatment to eradicate inflammation in the prostate gland, it is evident that backache due to such inflammation can be entirely relieved only by co-operation between the general practitioner, the general and orthopedic surgeon, the urologist, and the patient.

LOUIS GROSS, M.D.

Holloway, J. K., and Von Lackum, W. H.: Chronic Prostatitis. *Med. J. & Rec.*, 1925, cxxii, 23, 64.

The authors state that the prostate gland is infected in a large percentage of males, many of whom have no history of gonorrhœa. Prostatic infection is frequently responsible not only for numerous local and general symptoms, but also for conditions generally classified as of focal origin. In many cases prostatitis is latent and can be diagnosed only after repeated examination of the prostatic fluid subsequent to provocative stimulation. By provocative stimulation it is usually possible to estimate the degree of prostatic infection in three or four days. Systematic treatment of prostatitis and vesiculitis, consisting of a few urological procedures carefully, vigorously, and systematically carried out, is simple, and in most instances is followed by definite improvement.

Herman, L., and Carp, J.: Prostatic Abscess. *Ann. Surg.*, 1925, lxxxi, 1115.

Herman and Carp present an analysis of twenty cases of prostatic abscess treated by extra-urethral prostatotomy, and contend that incision and drainage is the one method of treatment which is based on sound surgical principles and insures a cure in the sense that subsequent morbidity is reduced to the minimum.

They report that they have seen cases of prostatic abscess in which complete recovery followed the spontaneous evacuation of the pus through the urethra but the symptoms recurred after longer or shorter intervals of apparent good health.

The differentiation between intense generalized prostatitis and prostatic abscess of gonorrhœal origin is beset by many difficulties, especially in the early stages when there are no symptoms or signs, with the possible exception of fluctuation, that are pathognomonic of abscess.

Under proper treatment and in the absence of gross suppuration, prostatitis usually shows rapid improvement. In some cases this may be mani-

fested primarily only by a decrease in the leucocyte count.

In suppurative cases, and especially when the abscess is centrally or cortically located, the leucocytes and the subjective symptoms, especially the pain, increase, and the gland continues to enlarge and becomes more tender. The experienced observer will be able to detect differences in the consistency of different parts of the organ, and may be able to determine the occurrence of periprostatic suppuration by noting a change from a well-circumscribed enlargement of the prostate to a more diffuse bogginess in the prerectal area.

Chills are rarely associated with prostatitis and almost always denote the presence of an abscess.

Operation should be an extra-urethral procedure. The introduction of an instrument may rupture the abscess and thus favor the formation of a fistula. The absence of a guide renders operation difficult. After exposure of the apical portion of the gland, an abscess should be opened by plunging a curved hæmostat into each lobe, guided by a finger in the rectum. The instrument should be directed so that its convexity is toward the rectum. Care must be taken that the point of the instrument does not enter the urethra or bladder.

In cases in which the posterior surface of the prostate can be exposed, the abscesses are opened by making a vertical para-urethral incision into each lobe if palpation indicates the presence of pus. When in doubt, the authors incise. The opening is enlarged by the use of a hæmostat and all septa are then broken down by the use of a finger as a curette. The cavity or cavities are drained by rubber tubes supplemented by iodoform gauze strips if there is a tendency to bleed. The skin incision is closed with silkworm gut sutures; no attempt is made to approximate the deeper tissues. The majority of incisions which are made in gonorrhœal cases heal by first intention except at the point of emergence of the drains.

Hypodermoclysis is used postoperatively in most instances, and especially in cases in which kidney function has been impaired or septic symptoms have been prominent. The tube and part of the gauze are removed after forty-eight hours, and the remaining segment of gauze on the following day.

Mercurochrome (2 to 5 per cent) has been found of value, but the stronger solutions are avoided if there is a communication with the urethra. In the latter type of case, catheter irrigations of the bladder and deep urethra are carried out, beginning about the fifth day.

In a few of the very extensive cases it is necessary to use the deep Kollmann dilator as a final step in the treatment.

Of the twenty cases reported, eighteen are regarded as cured. Two patients were benefited but not cured; one (a tabetic) had a urinary fistula and the other had a small persistent fistula in a lateral perineal incision for years.

The authors draw the following conclusions:

1. Prostatic abscess is often an extremely serious condition.

2. Cases not operated upon frequently end fatally or in chronic invalidism.

3. Abscesses of non-gonorrhœal origin are far more serious as a class than those complicating acute gonorrhœa.

4. A clinical differentiation between intraprostatic and periprostatic abscess is often impossible.

5. The treatment of choice is perineal extra-urethral prostatotomy.

6. Diversion of the urinary stream by external urethrotomy is advisable in cases complicated by a large periprostatic collection and especially in chronic cases.

7. Leucocytosis is one of the most important diagnostic signs. LOUIS GROSS, M.D.

Herman, L.: Suprapubic Prostatectomy in Bad Surgical Risks. *Atlantic M. J.*, 1925, xxviii, 657.

The author discusses the relationship between the clinical aspects of prostatism and the various laboratory tests.

Statistical studies of fatalities following operations show that the most frequent causes of death are renal failure, hæmorrhage, shock, and sepsis. Whenever there is any risk, a two-stage prostatectomy is safest. Cases with risk are classified as follows:

1. Those with severe infection in which the prostate is firmly adherent. In these cases there is great danger of hæmorrhage.

2. Those in which cardiorenal conditions are associated with major pathological changes in the kidneys.

3. Those in which cardiac weakness dominates the picture.

4. Those of carcinoma of the prostate. Carcinoma is a contra-indication to enucleation.

5. Those with diabetes, anæmia, vasomotor failure, and pulmonary conditions. Such cases require medical treatment.

Cystoscopic examination is dangerous in cases with risk.

The anæsthetic of choice for operation is nitrous oxide oxygen. MAURICE MELTZER, M.D.

Bell, F. G.: Tumors of the Testicle: The Teratoid Group. *Brit. J. Surg.*, 1925, xiii, 7.

The majority of testicular tumors belong to the teratoid group. The term "teratoma" should perhaps be reserved for the rare, highly complex types displaying structures which can reasonably be interpreted as a successful attempt on the part of the tumor to produce adult or fully formed structures or organs such as the alimentary tract, the bones, the kidneys, the thyroid, the breasts, and the spinal cord. The term "teratoid" should be applied to the common, less complex types in which the activities of the tumor are abortive and produce only a mixture of tissues. The term "mixed tumor" should be restricted to a special type which resembles certain parotid tumors.

Macroscopically, teratoma testis varies in size from that of a golf ball to that of a fetal head. Its surface, which may be smooth or lobulated, may appear uniform in consistency, or may be soft or even fluctuant in parts or stony hard. Sagittal (vertical) section may show the origin of the growth to be in the mediastinum testis. In the early stages the body of the testis is usually visible at some part of the periphery of the tumor, commonly at the summit. The presence of a peripheral band of testicular tissue separated from the tumor substance by a condensed fibrous layer or capsule is highly characteristic of teratoma but not pathognomonic. While a cystic appearance is very characteristic, there are numerous apparently solid tumors of a teratoid character. Cartilaginous nodules are sometimes visible in the cut surface, and in rare cases may appear to form the bulk of the tumor.

Histologically, teratoid tumors may be divided into the three following groups:

1. Mesoblastic derivatives. Round or oval nodules or crescentic plates of cartilage are characteristic. A fibrocellular myxomatous matrix, sometimes sarcomatous in type, is almost equally characteristic and always suggests the teratoid character of the tumor.

2. Hypoblastic derivatives. These appear as tubules or spaces lined by cubical or columnar cells and often suggest adult glandular structures, especially intestinal mucosa.

3. Epiblastic derivatives. These appear as spaces lined by stratified squamous epithelium and cell-nest formation.

To summarize, the common mesoblastic element (other than stroma) is represented by cartilage; the hypoblastic element by glandular tubules or spaces; and the epiblastic element by stratified epithelium. The mesoblast is represented by hyaline cartilage, bone, plain and striped muscle, fat, and lymphoid tissue. The hypoblast is represented by glandular tubules or spaces lined by cubical or columnar cells —digestive tubes, respiratory tubes, and certain glandular organs, especially the thyroid. The epiblast is represented by stratified epithelium, especially cell nests, neuro-epithelium, trophoblastic epithelium, and possibly melanotic patches.

It is generally stated that teratoma testis is usually benign but may become malignant and that the resultant tumor may be cancerous or sarcomatous, depending upon whether the malignant change affects the connective tissue or the epithelial structures. This statement requires qualification. The essentially malignant character should be stressed, and the marked tendency of the epithelial elements, especially the hypoblastic, to assume malignancy requires greater emphasis.

The relative representation of the various blastodermic derivatives varies greatly in different specimens. Overgrowth of one blastodermic element with partial or total (?) suppression of the others occurs frequently. Hypoblastic overgrowth is most common, mesoblastic next in frequency, and epiblastic least common. Such overgrowth may be simple or malignant, and produces many variations from the typical three-layered teratoma.

The following classes of specimens are described:

1. The typical tridermal teratoma—the "fibrocystic disease" of the older terminology.

2. The solid, apparently homogeneous tumor containing heterologous elements.

3. Mesoblastic overgrowth: (a) cartilaginous; (b) myomatous; (c) "mixed" tumors of myxochondro-endotheliomatous type resembling certain parotid tumors.

4. Hypoblastic overgrowth: (a) simple papillary adenofibroma with heterologous elements; (b) adenocarcinoma with heterologous elements; (c) pure adenocarcinoma; (d) spheroidal-cell scirrhous carcinoma.

5. Epiblastic overgrowth: (a) dermoid cysts (so-called); (b) squamous carcinoma (epithelioma); (c) basal-cell carcinoma (rodent ulcer); (d) chorion-epithelioma; (e) neuro-epithelial tumors.

Teratoma testis is potentially very malignant. Many carcinomata of the testis are directly related to the malignant conversion and overgrowth of the epithelial, more especially the hypoblastic, elements of teratomata. The malignant change may be selective, but may affect both epithelial and connective tissue elements in the same tumor. The more adult the structure of the teratoma, the less liable is it to malignant change.

The fact that the bulk of the testis proper is usually situated toward the upper pole suggests that, in early cases at least, some diagnostic use might be made of it. Testicular sensation limited to the upper pole might occasionally give a clue to the nature of a tumor. In early cases it would appear possible to enucleate the teratoma from its capsule, leaving the testis and epididymis intact. However, such conservatism in a paired organ would rarely be indicated. Roentgenography may occasionally give additional information if the cartilaginous elements of the tumor are well developed, and especially if bone is a prominent constituent as in the teratomatous (dermoid) cyst.

LOUIS NEUWELT, M.D.

MISCELLANEOUS

Neuswanger, C. H.: Iodized Oil as Pyelographic Medium. *J. Am. M. Ass.*, 1925, lxxxiv, 1816.

In comparative tests of the iodized oil solutions employed by Forestier and Sicard and a 12.5 per cent sodium iodide solution, the former were found to produce more definite shadows on the pyelographic plate than the latter and caused no untoward symptoms. GILBERT J. THOMAS, M.D.

Redewill, F. H., and Potter, J. E.: Mercurochrome -220 Soluble in Genito-Urinary Diseases. *J. Am. M. Ass.*, 1925, lxxxiv, 1891.

The authors conducted a series of experiments to determine why certain cases show no reaction to

mercurochrome; to detect in advance, if possible, the cases in which there is hypersensitivity to mercury, and to devise a mercurochrome test of kidney function. Their findings and conclusions are as follows:

1. Mercurochrome-220 soluble is one of the most important new agents for intravenous medication.

2. This drug is excreted in large quantities by the kidneys and secreted also through the prostate, seminal vesicles, and other glands of the genito-urinary tract. Therefore in genito-urinary diseases it will come into direct contact with the inflamed areas by way of the urine and blood stream.

3. To obtain the best results, it should be given in doses small enough to avoid too early saturation. The patients who respond best to intravenous mercurochrome injections have mild reactions.

4. Acute rheumatism, synovitis, myalgia, neuritis, arthritis, and other manifestations due to the absorption of infection from the prostate and seminal vesicles have cleared up on the intravenous administration of mercurochrome.

5. A large number of cases of acute gonorrhœal urethritis, epididymitis, prostatis, and seminal vesiculitis have cleared up rapidly under this medication.

6. The drug should be freshly prepared and given every forty-eight hours.

7. When it is given judiciously, mercurochrome is one of the most efficient remedies for use in ambulatory cases; patients can be treated with it in the dispensary and the clinic.

8. Expressed prostatic fluid and seminal fluid have a marked bacteriostatic action.

9. Patients who are hypersensitive to intravenous mercurochrome injections will secrete a proportionally greater amount of the drug in the saliva and the gastro-intestinal tract than by way of the kidneys.

10. By the use of the diphenylcarbazid test for mercury in the seminal fluid and the mercurochrome test of kidney function, it is possible, with the first intravenous injection of mercurochrome, to determine definitely whether the patient is able to withstand the continuous use of this drug.

LOUIS GROSS, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Southard, J. D.: X-Ray Treatment of Bone Tuberculosis. *Radiology*, 1925, v, 34.
Costolow, W. E.: Radiation Treatment of Bone Tumors. *Radiology*, 1925, v, 37.

SOUTHARD reports that of twenty-seven cases of bone tuberculosis (many with joint involvement), which were treated with the X-ray, twenty-two were cured and five were benefited. A cure is indicated by regeneration of bone.

COSTOLOW reports three cases of bone tumor which were cured by radiation. Two of the tumors were probably benign, but one was found by biopsy to be giant-cell sarcoma.

The first case was that of a girl, 12 years old, who developed a tumor of the tibia following an injury. In the two years that have elapsed since the treatment there has been no recurrence of pain or other symptoms.

The second case was that of a 38-year-old man who complained of pain in the hip. Thinning of the acetabulum was found. The X-ray diagnosis was a cyst, giant-cell sarcoma, or osteochondroma. Twenty-two months after the treatment the patient was still free from symptoms and the cystic area was almost completely calcified.

The third case was that of a boy 12 years old who had a tumor of the thigh. Biopsy showed the presence of giant cells and mitotic figures. Both radium and the X-ray were used. Three and a half years after the treatment a clearly defined bony mass was all that remained of the neoplasm.

ROBERT V. FUNSTEN, M.D.

Talbott, J. A.: The Treatment of Anterior Poliomyelitis. *Virginia M. Month.*, 1925, lii, 216.

In discussing the pathology of anterior poliomyelitis the author emphasizes the general toxæmia and the extreme primary paralysis from pressure. The condition has four stages: the stage of onset, a stationary period, the period of partial recovery, and the chronic stage.

The treatment varies according to the stage of the disease. In the acute stage the patient should be placed at complete rest in order to protect the inflamed nerve cells from peripheral stimuli. For this purpose the plaster bed or Bradford frame may be used.

The limbs should be immobilized to prevent contractures. Gentle massage should be given only after the acute tenderness has disappeared.

In the stage of convalescence muscle training is indicated and massage should be continued. Weight-bearing may be allowed only with a proper brace to prevent contractures and deformity from over-balance and muscle pull.

In the chronic stage massage should be continued. It is in this period that the judicious use of apparatus is advisable and operations for stabilization and tendon transplantation may be indicated. Fatigue must be prevented.

In conclusion, the author cites instances of favorable results given by the Rosenow serum, but states that he has never used it.

ROBERT V. FUNSTEN, M.D.

Mitchell, J. I.: The Residual Paralysis and Deformity of Anterior Poliomyelitis. *J. Bone & Joint Surg.*, 1925, vii, 619.

Anterior poliomyelitis is an infectious disease characterized by inflammation of the gray substance of the spinal cord and attended by motor paralysis and deformity.

The course of the condition may be divided into three stages: (1) the acute febrile stage occurring usually in infants or young children, (2) the stage of repair of the damaged cord and re-establishment of function during a period of months or years, and (3) the stage when improvement ceases and a permanent residual paralysis remains. The residual state of deformity may progress or become accentuated by growth.

The disease is of wide geographic distribution and often occurs in epidemics. New York and the New England states rank first as endemic foci.

Many problems pertaining to the pathological, serological, bacteriological, and immunological study of the disease have been solved by animal experimentation. Flexner and Rosenow have shown by experiments that the infecting organism probably enters the body through the upper respiratory passages. Children whose tonsils have been removed are rarely affected during an epidemic of anterior poliomyelitis.

In the Mayo Clinic series of 350 patients, the disease occurred during the first three years of life in 44 per cent, but the ages ranged from 15 months to 59 years.

Trauma was given as the etiological factor in thirty-six cases. The prodromal symptoms were chiefly gastro-intestinal: loss of appetite, vomiting, constipation, and diarrhœa. Fever and pain were also prominent symptoms. In most cases the paralysis appeared on the fourth day. In 37.5 per cent the initial involvement occurred in both legs.

Usually the patient does not seek aid until after the deformity has become well established. In the series of cases reviewed the average duration of the paralysis was 8.4 years. The paralysis is usually more severe in the legs than in the arms, and certain

muscles are affected more than others. The anterior tibial muscle is most commonly paralyzed.

In the last stage of the disease a limp was the chief complaint in 44 per cent of the cases. The second most common complaint was deformity of the feet and legs. Talipes equinus and talipes valgus were the most common deformities. Scoliosis occurred in 31.4 per cent of the cases.

Marked improvement follows proper treatment early in the disease. The treatment usually consists in rest, the use of splints and braces, massage, the application of heat, and muscle training. In many cases surgical treatment of the residual deformity is of great benefit. There are three types of operations: (1) those correcting deformities, (2) those stabilizing the limb as well as correcting deformities, and (3) those increasing the function of the limb.

Wakeley, C. P. G.: An Ossifying Chondroma of the Rib Mistaken for Sarcoma. *Brit. J. Surg.*, 1925, xiii, 175.

Wakeley reports the case of a man 42 years of age who, in 1916, sustained a severe contusion of the right thorax and in August, 1923, noticed a smooth lump the size of a walnut 1 in. above and external to the right nipple. Pain and weakness developed on the inner side of the right forearm with numbness and tingling of the ring and little fingers.

Examination revealed a large, rounded, pulsating tumor of the right thorax which was fixed to the chest wall; slight weakness of the muscles of the right forearm and hand supplied by the lower cord of the brachial plexus; and atrophy of the thenar eminence. The X-ray diagnosis was malignant tumor.

At operation, a lobulated, pearly blue tumor measuring 7 by 6 in. was removed from the fourth rib. On section, definite areas of ossification were found. Microscopic examination showed the tumor to be a typical chondroma. When the patient was seen six months after the operation he had completely recovered.

RUDOLPH S. REICH, M.D.

Todd, A. H., Elmslie, R. C., Jones, R., and Others: Discussion on the Differential Diagnosis of Non-Tuberculous Coxitis in Children and Adolescents. *Proc. Roy. Soc. Med.*, Lond., 1925, xviii, Sect. Orthop., 31.

TODD classifies non-tuberculous coxitis as follows: (1) the traumatic type, (2) coxa vara, (3) the infective type, (4) the secondary type, (5) arthritis deformans juvenilis, and (6) miscellaneous cases.

Simple transient coxitis occurring after trauma is associated with pain on movement of the hip and with limping. Improvement usually occurs spontaneously. In acute traumatic chondritis resulting from trauma there is a persistent dull ache in addition to the more acute pain on motion. In this condition a patch of articular cartilage has been bruised and is acutely inflamed. In most cases recovery results after a few days of rest in bed. In other cases the symptoms frequently recur and are often very difficult to differentiate from those of tuberculosis of the hip.

Juxta-epiphyseal strain may result from physical injury; rarely, the upper epiphysis is separated. As coxa vara may develop, the patient must be kept under observation and subjected to periodical X-ray examinations. In the presence of a nutritional disorder, rickets, or an endocrine disorder, juxta-epiphyseal strain may be caused also by the body weight. In other cases, such as those of excessive obesity, it is of static origin.

In the early stages, coxa vara may be confused with tuberculosis because of the associated limp, pain, and shortening. The X-ray is of aid in the diagnosis. In early coxa vara only abduction is limited, whereas, in tuberculosis, motion is restricted in more than one direction.

Infective coxitis may follow a febrile condition such as pneumonia, measles, scarlet fever, typhoid fever, influenza, and gonorrhœal vulvovaginitis. It may result also from surgical conditions such as otitis media, tonsillitis, and operations on the tonsils and appendicular abscesses. While scarlet fever is rarely responsible, it is a very severe infection which may result in ankylosis with or without suppuration. Coxitis following measles is fairly common, but usually becomes cured after two months' treatment in a double plaster hip spica. If the symptoms persist, the condition progresses as tuberculosis of the hip, the tuberculosis following the lesion produced by the measles.

The coxitis following typhoid fever and influenza shows all grades of severity. If erosion of the cartilage occurs, ankylosis results. The more severe forms of the condition cause spontaneous dislocation. Gonorrhœal coxitis is usually very mild. While it persists for some time, it eventually resolves. Pneumococcal coxitis is of the so-called primary and secondary types. About 65 per cent of the secondary cases and 25 per cent of the primary cases are fatal.

Coxitis of secondary onset follows operations on septic areas. The infection is very acute. It usually follows the removal of tonsils and occasionally develops after the treatment of appendiceal abscesses. Pathological dislocation of the hip is frequent. In several cases the condition has been fatal. Coxitis secondary to acute or subacute epiphysitis occurs in children, with sudden onset, a rapid course, marked fever, and prostration. X-ray changes are demonstrable in a few days, and there is a marked leucocytosis. The epiphysis is rapidly destroyed, with resulting ankylosis. These findings differentiate the condition from tuberculosis. In the absence of other signs of tuberculosis, coxitis in an infant under 1 year of age is more likely to be due to a non-tuberculous cause.

Arthritis deformans juvenilis is a distinct condition affecting males only and occurring at about the seventeenth year of age. It is insidious in onset, slow in progress, and painful. It results in deform-

ity and ankylosis due to destruction of the articular cartilage. The X-ray shows cartilage destruction with peripheral bone formation.

Among the miscellaneous cases of coxitis are those in which recurrent attacks of pain and limitation of motion are caused by hæmophilia. This condition is benefited by a few weeks of rest in bed. Scurvy, another possible cause, has a characteristic X-ray picture. Intestinal pseudocoxitis, which is associated with pain in the hip, limitation of motion, and a limp, occurs in constipated children. The symptoms continue for about two or three weeks and disappear under treatment with laxatives and a low protein diet. Coxitis must be differentiated from lumbar caries, perinephritis, psoas myositis, syphilitic epiphysitis, hysteria, sacro-iliac affections, coxa valga, knee affections, and juxta-articular bursitis.

In the diagnosis of pseudo-tuberculous coxitis, the family history and the history of the disease must be given careful consideration and a careful study made of the temperature and pulse charts. The graduated von Pirquet test is of value if it is negative, but of no value if it is positive. The roentgenogram shows first decreased density and then a general haziness with distention of the joint cavity. Subsequently erosion is evidenced by an irregular fuzzy appearance of the joint. The most important test is the effect of moderate movement. In tuberculous coxitis the symptoms recur when activity is resumed following a period of rest, while in non-tuberculous coxitis this is rarely the case. Immobilization is best obtained by the application of a plaster hip spica.

FAIRBANK stated that there is a type of primary synovial disease which is complicated by early dislocation of the joint and is often remarkably painless. He cited two cases in which death resulted from tuberculous meningitis and the well-developed lip of the acetabulum served to distinguish the pathological dislocations from congenital dislocations.

GORDON stated that in tuberculosis the stained film almost always shows leucopænia with a relative lymphocytosis characteristic of the bacterial lesion, while in the infective group there is a leucocytosis with predominance of granular cells. As failure to find tubercle bacilli in the aspirated fluid by staining or cultural methods does not necessarily rule out tuberculous infection, animal inoculations should always be made. RUDOLPH S. REICH, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Steindler, A.: Skin-Flap Methods in the Upper Extremity. *J. Bone & Joint Surg.*, 1925, vii, 512.

A flap should be made, if possible, with its long sides parallel with the lines of tension and with careful consideration of the circulatory conditions. The free ends of abdominal flaps should converge more or less toward the umbilicus. The pedicle should be broad and its length should not be more than two or three times its width. Only from one-fourth to one-third of the diameter of the flap need be allowed for shrinkage.

The bed for a flap should be free from scar tissue, and absolute hæmostasis should be obtained. Small silkworm gut drains below the flap will take care of serum oozing. The flap should carry a substantial amount of subcutaneous fat. It must be placed without tension and carefully sutured with horsehair in healthy skin. Venous stasis must be prevented. Absolute immobilization in a plaster dressing is essential. In the average case the pedicle of the flap should not be cut before three weeks. Postoperative massage of the flap and after-splinting to prevent the recurrence of deformities are usually indicated.

CHESTER C. GUY, M.D.

FRACTURES AND DISLOCATIONS

Taylor, R. T.: The Preservation and Restoration of Function in Fractures and Dislocations. *Am. J. Surg.*, 1925, xxxix, 177.

In the shoulder a good degree of abduction and rotation must be obtained to insure good function. Therefore, after injury of the shoulder, the arm should be put up in abduction of about 90 degrees, or a little less, and slight forward extension. This will relax the deltoid and prevent adhesions from binding the arm to the side.

In all injuries to the elbow except fracture of the olecranon the position of choice for fixation is extreme flexion. In fractures of the olecranon the elbow should be maintained in complete extension for about three weeks and at the end of that time efforts should be made to restore flexion.

After fractures or other injuries around the wrist, the general rule is to splint the joint in hyperextension at about 140 degrees with the thumb in abduction.

It seems to be generally conceded that the best way to put up a fracture of the hip is in a spica cast in extreme abduction and extension. This insures a longer leg and an anatomical position as near normal as possible. For patients who appear to be too weak to stand a cast, the Balkan frame and extension may be used.

In fractures and dislocations of the knee, full extension is the position of choice.

The ankle should be put up at a right angle with moderate abduction of the foot.

In non-union of fractures the author has not been able to obtain good results from the use of cortical bone grafts or bone chips. The grafts break or become absorbed and give only mechanical fixation. Taylor therefore employs an osteoperiosteal graft which he cuts from the tibia about 1 mm. deep into the cortex with the rotary saw and removes with a chisel. This graft is laid over the fracture fragments and the fragments are fixed in alignment and held with bone clamps of the variety which does not completely encircle or penetrate the cortex. When

union becomes firm the clamps are removed under local anæsthesia.

The article contains thirteen detailed case reports.

WILLIAM A. CLARK, M.D.

Lambotte, A.: The End-Results of Osteosynthesis (Sur les résultats définitifs de l'ostéosynthèse). *Bull. et mém. Soc. nat. de chir.*, 1925, li, 463.

To refute the report that Belgian insurance companies refuse to insure persons who have been subjected to osteosynthesis, Lambotte submits a letter from the Director of the Mutual Society of Brussels which shows that in the period from 1909 to 1924 seventy cases were operated upon by him by this method at the request of the Society. In 84 per cent, a perfect or very good result was obtained. These were all severe cases in which the insurance company sought the aid of surgery to decrease marked loss of function.

From a study of nearly 1,000 cases of osteosynthesis, Lambotte concludes that if the operation is done with a correct technique, it accelerates consolidation by placing the osseous surfaces in intimate contact. He therefore believes it should be used in all fractures with displacement of fragments.

W. A. BRENNAN.

Adams, J. D.: Displacement of the Semilunar Carpal Bone: An Analysis of Twelve Cases. *J. Bone & Joint Surg.*, 1925, vii, 665.

In 5,062 injuries of the wrist reviewed by the Industrial Accident Board of Massachusetts there were nineteen uncomplicated dislocations of the wrist. Adams believes that the condition is frequently unrecognized and that therefore stereoscopic pictures should be taken of all wrist injuries. He reports twelve cases.

In true dislocation of the semilunar carpal bone the relation of this bone to the radius and os magnum is completely disturbed. Displacement is any degree of change from its normal position.

Persistent dorsal displacement of the midcarpal row produces permanent disability in the wrist. In early cases restoration to normal is possible, but when the condition has been present for some time it is extremely difficult, if not impossible, to effect a cure.

Closed reduction should be attempted only within forty-eight hours after the injury, and then with extreme care to prevent injury of the flexor tendons and the articular surface of the carpal bone.

Open reduction is attended with great danger of traumatizing the articular surfaces of the flexor tendons. Convalescence is long and the end-results are unsatisfactory.

Removal of the bone should be done in all cases in which there is limitation of dorsiflexion and palmar flexion interfering with the patient's work. Early movement is important.

In old borderline cases with only slight interference with function, it may be best not to undertake treatment.

The end-results of treatment should be judged on the basis of the patient's ability to do his original work.

CHESTER C. SCHNEIDER, M.D.

Speed, K.: Fracture of the Carpal Navicular Bone. *J. Bone & Joint Surg.*, 1925, vii, 682.

In falls on the wrist with the palm down, most of the violence is transmitted through the radius by way of the navicular bone. Fracture or dislocation of the navicular bone may occur with Colles' fracture. The bone may be fractured transversely or crushed, or the tuberosity may be pulled off. The tuberosity fracture is of no consequence, and usually heals by bony union. Transverse and crushing fractures, however, shut off the blood supply to the cancellous bone and eventually cause it to undergo necrosis. After a number of years, new bone formation may produce ankylosis at the radiocarpal and midcarpal joints.

The symptoms of navicular fracture are restriction of wrist motion, especially extension, pain on movement, a weak grip, tenderness over the bone on pressure, and swelling. Roentgenograms confirm the diagnosis.

In very early cases the treatment is immediate immobilization in slight radial and volar flexion for from seven to eight weeks, followed by gradual motion and daily baking. In old cases which have remained undiagnosed for a week or longer, carpalectomy of the navicular bone is the only satisfactory treatment. Cases of long standing with ankylosis may require removal of the entire proximal row.

CHESTER C. SCHNEIDER, M.D.

Nové-Josserand, G.: Malformations and Subluxations of the Hip (Malformations et subluxations de la hanche). *Rev. d'orthop.*, 1925, xxxii, 85.

For a long time it was believed that incomplete luxations were only a stage in the development of complete luxations, but roentgenography has shown that they may occur not only in infancy but at any age.

The author has studied subluxations of the hip in children between 1 and 5 years of age, in children between 5 and 15 years of age, and in adults. In the cases of children between 1 and 5 years old special care must be taken in making the roentgenograms because the deformity is sometimes slight and as the skeleton is for the most part cartilaginous the contours of the joints are not distinguishable, only the form of the centers of ossification being clear.

The best method is to consider the relation of the inferior-internal angle or spine of the neck to the U-shaped line which marks the bottom of the acetabulum. Normally the spine is on a level with the base of the U. If it is above this it shows an upward dislocation. To detect an outward displacement it is necessary to consider the relation between the spine of the neck and the U as compared with the normal side, or the relation of the spine to the ischium. Up to the age of 2 years the spine is tangent to this shadow, and a disturbance of this rela-

tion indicates a displacement. The most constant malformation is an enlargement of the cavity of the acetabulum upward and a decrease in its depth. The article includes roentgenograms of subluxations of this and other types.

Deformities of the lower part of the acetabulum are less constant and less important. The double U-shaped line is often broadened, showing a thickening of the base of the cavity, but sometimes it is almost normal. In young infants the upper end of the femur is almost always normal. The clinical signs are variable because they depend not only upon the degree of flattening of the acetabulum and the subluxation, but also on the condition of the capsule and muscles. If the capsule and muscles are in good condition there may be no functional disturbance, but if the capsule is relaxed and the muscles are weak the child will limp at an early age. This explains why the limping may be intermittent and may not occur before adult life or even old age. Sometimes complete luxation results. It has been said that in some cases the condition may become cured spontaneously. In others it remains unchanged. The author doubts whether true spontaneous recovery ever occurs. At any rate it is not frequent enough to justify withholding treatment, for if treatment is not given there is danger of arthritis or osteochondritis in later life.

The treatment is the same as that for complete luxation. Reduction is of course easier. The limb should be fixed in moderate abduction and strong flexion, and the time of immobilization should not be shortened because the luxation is slight. On the contrary, the laxity of the capsule and the lack of bony support sometimes make it necessary to keep the limb in a plaster cast flexed at a right angle for eight months.

In the cases of children between 5 and 15 years of age, the acetabulum is almost always atrophied and the deformity consists in a raising of its roof which decreases its depth. Clinically there is pain, sometimes occurring in acute attacks and generally brought on by fatigue. There is also a slight limp. In rare cases this form of the condition leads to complete luxation. Osteochondritis was not found in any of the cases. At this age the treatment should be limited for the most part to rest during the periods of pain and the patient should be forbidden to take long walks or to stand for long periods of time. Reduction and fixation does not give such good results as in younger patients, and the manipulations necessary for reduction may favor the development of arthritis.

Of the author's adult patients the oldest was 56 years of age. Five had signs of arthritis, but the preexistence of a congenital malformation was shown in four of them by the presence of a congenital luxation of the other side and in one by a roentgenogram made before the arthritis developed. The anatomical forms were similar to those in the older children. Clinically two forms of the condition were distinguished—one with pain only and one with arthritis. Some of the patients had no limp and others a slight limp. There was little or no shortening. The treatment in these cases should be limited to rest and the use of physical agents such as heat, hydrotherapy, and massage. In one case, arthrodesis of the hip was performed. The functional results were imperfect, but the pain was relieved.

A review of these cases shows that subluxation of the hip may be present at any age, and that its clinical history is clearly different from that of arthritis or osteochondritis. The different theories as to the relations of these conditions are discussed. The author concludes that Preiser's mechanical theory is not justifiable; that the congenital predisposition to osteochondritis or arthritis is due to the constitution rather than to the form of the bone. Because of a defective constitution, the bone offers little resistance to traumatism or infection, this explaining the close relationship between congenital luxations and these diseases.

AUDREY G. MORGAN, M.D.

Reich, R. S.: A Bifurcation Operation for the Treatment of Irreducible Dislocations of the Hip Joint. *J. Bone & Joint Surg.*, 1925, vii, 598.

In the operation described an incision is made in the upper lateral surface of the thigh and an oblique osteotomy of the femur is done exactly over the center of the acetabulum. The lower fragment is then turned in and its end inserted into the acetabular fossa. The leg is placed in abduction at 30 degrees in a body spica. If subsequent X-ray examination shows that the fragment has slipped out of the fossa, the manipulation is repeated.

The cast is left on for three months. At the end of that time the patient is allowed up on crutches and weight-bearing is begun. The operation is similar to the one now performed in the Lorenz Clinic in Vienna. It has been done by the author in five cases, with satisfactory results in all. It is entirely extra-articular, comparatively simple, and not attended by shock. It overcomes lordosis and it gives a movable functional hip joint. It may increase the shortening of the leg but not to a marked degree. It is indicated in all irreducible dislocations of the hip joint when bloodless reduction has been unsuccessful or the patient has passed the favorable age for bloodless reduction.

CHESTER C. GUY, M.D.

Kolodny, A.: The Architecture and the Blood Supply of the Head and Neck of the Femur and Their Importance in the Pathology of Fractures of the Neck. *J. Bone & Joint Surg.*, 1925, vii, 575.

The three main changes in the anatomical configuration of the femur from early fetal life to adult age are antetorsion due to static function of the joint, flattening of the joint, and bending of the neck by weight bearing, the angle being reduced from 145 degrees in the newborn to 115 degrees in the adult.

In a series of roentgenograms of the upper portions of the femur the author identified three distinct

groups of bony lamellæ of importance in the architecture of the femoral neck. One group, composed of "tension" lamellæ, arise externally in the region of the greater trochanter, run through the neck to the head, and prevent laceration of the neck. A second group, the "pressure" lamellæ, arise on the internal side and go to the head along the line of force during weight bearing. The third group, in the trochanteric region, cross the tension lamellæ at right angles.

The space in the neck between these three groups of lamellæ, which is known as "Ward's triangle" is the point where atrophy and rarefaction of the upper femur begin in skeletal atrophy and old age. It is also the region where experimental fractures due to vertical compression occur.

Experiments to determine the amount of weight required to fracture the femur revealed the importance of age, sex, and race, and the direction of the force. In general, the vertical compression weight necessary to fracture the femur of a middle-aged male was 1,200 lbs. and the lateral compression weight about 375 lbs.

External rotation of the thigh in unimpacted fractures of the neck of the femur is due to the increased tension on the ischiofemoral ligament caused by the hæmorrhages about the site of the fracture plus the muscular fixation of the external rotators inserted on or about the great trochanter.

The head and neck of the femur are supplied by the following vessels:

1. Vessels from the femoral diaphysis, which are of little importance.

2. Epiphyseal vessels entering at the edge of the articular surface of the head and running parallel with the neck in the superficial periosteum.

3. Vessels of the ligamentum teres, which are of no evident importance in the nutrition of the head in adult life.

4. Periosteal vessels which are of great importance and in fractures of the neck are injured by displacement of the bone fragments. It is because these vessels are less damaged in impacted fractures that the prognosis of such fractures is more favorable than that of displacement. CHESTER C. GUY, M.D.

Orr, H. W., and Thomson, J. E. M.: End-Results to Illustrate the Value of Fixed Traction in the Treatment of Fractures of the Lower Extremity. *J. Bone & Joint Surg.*, 1925, vii, 696.

By "fixed traction" is meant traction applied at the time when the fracture is reduced and so fixed in the immobilizing apparatus that it remains undisturbed and unaltered until at least preliminary healing has taken place. The authors use moleskin adhesive plaster traction straps 3 in. wide and varying in length according to whether they are to be used for fractures of the leg or fractures of the thigh. Into the distal end of the straps the frayed ends of a pliable strong rope are sewed to be used for traction.

The straps are applied to both sides of the limb well above the site of the fracture (unless the fracture is compound) and fixed in place with muslin bandages. The patient is anæsthetized on a fracture table and traction is established by the use of the rope ends attached to the traction device, the pull being made and continued until the limbs are of equal length. A cast is then applied in the usual manner, extending as low on the extremity as the ankle. After the plaster has set sufficiently, traction having been continuously maintained by the foot bandage, the traction ropes are cut from the holding device, turned back against the leg portion of the cast, and embedded by several turns of the plaster bandage. The foot is then wrapped in sheet wadding and the cast applied with the foot at a right angle to the leg.

In some instances tongs or pins have been used instead of adhesive plaster. In certain cases in which apposition of the fragments could not be obtained direct leverage applied to the fragments gave good results.

In the author's series of ninety-three cases of fracture of the lower limbs there was not a single case of non-union. In twelve cases there was moderate disability. In twelve, open operation was necessary. In nine, there was from ¼ to ½ in. of shortening. In eighty-one cases the results were good.

CHESTER C. SCHNEIDER, M.D.

Brocq, P., and Panis, G.: Operative Technique in Condylar Fractures of the Tibia (Technique de l'intervention sanglante dans les fractures condyliennes du tibia). *J. de chir.*, 1925, xxv, 417.

In condylar fractures of the tibia the treatment of choice is open operation. These are articular fractures in which hæmarthrosis is constant. Ankylosis is especially to be feared because early mobilization is impossible. This alone is an important reason for operation. Moreover, condylar fractures, whether vertical or oblique, are for the most part characterized by lateral or anteroposterior displacement and malalignment of the fractured condyle. Even if slight, these changes modify the support of the femur by the tibia, producing lateral deviation of the limb and interfering with the action of the knee joint by causing a deformity of the articular surface of the tibia.

To prevent varus and valgus, the fractured fragment must be replaced and maintained in position. Osteosynthesis permits the re-establishment of the normal anatomy of the knee joint and when this has been attained mobilization may be begun early, the danger of ankylosis is removed, function is rapidly restored, and a good result is obtained.

The operation consists in opening the joint, reducing the fracture under the control of the eye, and the performance of osteosynthesis by screws or other means.

A U-shaped incision is made immediately under the anterior tuberosity. The branches of the incision are about 3 cm. from the lateral borders of the patella. Reduction of the fracture and osteosynthesis are easy. The only difficulty is the temporary removal of the obstruction offered by the patella

and patellar tendon. This may be done by section of the patellar tendon or resection of the tibial tuberosity, but the first is objectionable. The authors resect the anterior tuberosity of the tibia by cutting from the bone with the Gigli saw a trapezoidal wedge which includes the insertion of the patellar tendon in its upper surface. The larger lower surface corresponds to a transverse plane about 15 mm. beneath. The sides of the trapezoid join the two bases at an angle of 45 degrees.

When the block carrying the patellar tendon with it is temporarily removed, easy access is gained to the site of the fracture and the necessary manipulations for exact reduction and maintenance of the fragments by osteosynthesis can be easily carried out. The block including the insertion of the patellar tendon is then replaced and soon becomes consolidated with the tibia.

This temporary resection was recommended by Kirschner in 1913 and has been successfully employed by Brocq in arthrotomies.

The technique of the various stages of the operation is described in detail and five cases are reported.

Since the replaced trapezoidal block soon becomes consolidated, mobilization of the joint can be begun on the fifth or sixth day after the operation.

Of the authors' five patients, only one could be traced eighteen months after the operation. This patient walks naturally and is able to run up and down stairs with ease. There is no functional difference between the limbs. The X-ray does not show rarefaction around the osteosynthesis material and there is no solution of continuity in the site of the temporarily removed block of bone. The rapidity of the consolidation of the block is due to the great vascularity of the region. W. A. Brennan.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Gabriel: Experimental Investigations on the Effect of the Roentgen Rays upon the Blood Vessels (Experimentelle Untersuchungen ueber die Einwirkung der Roentgenstrahlungen auf die Gefaesse). *Fortschr. a. d. Geb. d. Roentgenstrahlen*, 1924, xxxii, 158, 168.

As a result of microscopic studies of the capillaries, David and Gabriel have come to the conclusion that the roentgen rays affect the nerve elements in the walls of the blood vessels, chiefly the contractile substance. In both the superficial and the deep layers of the tissues early and typical vascular changes were always demonstrable. To study the effect of the rays upon the vessels of the internal organs, Gabriel chose the kidney. Irradiation was done with the organ *in situ* through one area on the back, with the use of 22 kv., 3 ma., ½ mm. of copper and 1 mm. of aluminum. The deep dose was 32 per cent.

The earliest change noted was marked dilatation of the afferent vessels. Later there was marked filling of the glomeruli followed by hæmorrhages into Bowman's capsule and shrinkage of the glomeruli or destruction of the cells of the walls. In older cases there was connective tissue proliferation arising from Bowman's capsule and the adventitial tissue. Macroscopic examination of the adrenals showed contraction of the cortex, while microscopic examination demonstrated that the most marked changes occurred in the zona reticularis and fasciculata.

By perfusing Ringer's solution through the kidney by way of the artery and counting the drops which fell per minute from the vein, it was found that strong doses of the rays caused contraction of the vessels while weaker doses caused their dilatation. The latter could not have been a postmortem change as the vessels still reacted to adrenalin and barium chloride.

In the author's opinion, these findings confirm the theory that in anuria the effect of the roentgen rays is exerted primarily through the blood vessels.

HAPPEL (Z).

Reid, M. R.: Abnormal Arteriovenous Communications, Acquired and Congenital. III. The Effects of Abnormal Arteriovenous Communications on the Heart, Blood Vessels, and Other Structures. *Arch. Surg.*, 1925, xi, 25.

The author states that a study of his cases, of many cases reported in the literature, and of the results of his experimental work, leave no doubt that a collateral circulation develops around an arteriovenous fistula which is more abundant even than that which develops after the ligation of a main artery.

Zinninger and Reid, by producing arteriovenous fistulæ between the femoral vessels in one leg of a dog, ligating the same vessels in the other leg, and then making roentgen-ray examinations, have proved that a much more extensive collateral circulation develops on the side of the fistula. In the light of these experiments and of observations made on patients, they are inclined to believe that an arteriovenous fistula is the most powerful stimulus to the development of a collateral circulation.

The veins involved in these anastomoses and those subjected to increased pressure as the result of the fistula become dilated. The dilatation of the feeding artery or arteries to a simple angioma is probably fundamentally the same as the dilatation of the arteries proximal to an arteriovenous fistula or cirsoid aneurism. While the etiology of the venous dilatation seems evident, no adequate explanation for the dilatation of the proximal arteries or the dilatation of the heart has yet been made.

To a certain extent, the mechanism of the dilatation of the vessels in an arteriovenous aneurism works in a vicious circle; as the vessels dilate the fistula directly responsible for their dilatation also dilates.

The effect of arteriovenous fistulæ on the heart is now well known, and numerous cases in which a dilated and hypertrophied heart has returned to practically its normal condition following the cure of a fistula have been reported.

It would seem that the effect of an acquired arteriovenous fistula on the proximal portion of the involved artery might be used as a good index of the seriousness of the lesion so far as the heart is concerned.

An interesting observation made by the author was the absence of cardiac complications in his cases of congenital abnormal communications and cirsoid aneurisms. Although the proximal arteries dilate tremendously in cirsoid aneurisms, cardiac changes are rarely associated with this condition.

The tachycardia following restoration of the vessels and the bradycardia following excision of the vessels in cases of arteriovenous aneurism do not persist longer than a week or ten days.

In the parts supplied by the vessels involved in an arteriovenous aneurism there is marked impairment of the circulatory balance. The normal circulatory balance is disturbed by the rise in the venous pressure and the fall in the arterial pressure distal to the fistula. In arteriovenous aneurisms the surface temperature in the region of the lesion is elevated, while in the part distal to the lesion it is lowered.

Among other effects of abnormal arteriovenous communications which were noted in the cases re-

viewed, were a marked angiomatous condition in the region of the fistula; increased pigmentation of the skin distal to the fistula; ulceration with serious hæmorrhage distal to the fistula; marked œdema of the arm; headaches; dizziness; diplopia; annoyance due to the thrill and bruit; exophthalmos; ophthalmoplegia-paralysis of the sixth nerve frequently persisting after a cure of the intracranial fistula; calcification of the vessels at the site of the fistula; muscular atrophy; paræsthesias; physical disability; thickening of the subcutaneous connective tissue (several cases); and nerve disturbances other than those caused by direct injury to the nerves at the time of the production of the fistula. In one case there was a glove type of anæsthesia associated with subjective sensations and partial muscular paralysis of the hand and arm.

The irritation of the perivascular sympathetic nerves due to the arteriovenous fistula may produce constant contraction of the terminal arteries and thus not only explain atypical paralysis but also, in a measure, the generally poor circulation distal to an arteriovenous aneurism.

The article is supplemented by sight illustrations and two charts. The conclusions drawn are as follows:

1. An arteriovenous fistula is a powerful stimulus to the development of a collateral circulation, much greater even than the stimulus of ligation of the vessels.

2. A fistula between an artery and vein leads to marked changes in the vessels; the arteries proximal to the fistula become dilated and thin walled, and often show marked degenerative changes. A true aneurism may form in an artery proximal to a fistula. The veins dilate and their walls may become thickened.

3. A fistula between large vessels may lead to grave cardiac disturbances or even to sudden death.

4. The circulation of a limb distal to a fistula is usually markedly impaired, even though there is an increase in the capillary bed.

5. The surface temperature distal to a fistula is lowered, while after extirpation of the fistula it may be several degrees higher than it is normally.

6. Arteriovenous or cirsoid aneurisms situated in the extremity of a growing person may cause a considerable increase in the length of that extremity.

7. A kidney does not live after complete reversal of its circulation. CARL R. STEINKE, M.D.

Reid, M. R.: Abnormal Arteriovenous Communications, Acquired and Congenital. IV. The Treatment of Abnormal Arteriovenous Communications. *Arch. Surg.*, 1925, xi, 237.

The prognosis in cases of untreated, abnormal arteriovenous communications is uncertain. It is generally true that abnormal arteriovenous lesions of the arms, neck, and head are better tolerated than are those of the lower extremity. As a rule, the prognosis is dependent directly upon the size of the vessels involved and the size of the fistulous opening. Spontaneous healing usually occurs within the first six months if it is going to occur at all. Thrombosis is perhaps the most common cause for the spontaneous healing of angiomata.

Non-operative treatment of arteriovenous aneurisms has proved so unsuccessful and often so disastrous that efforts along this line have been abandoned. Treatment by compression, the injection of coagulating fluids, and the use of the galvanopuncture certainly should not be attempted.

The best treatment for arteriovenous aneurisms is operative treatment. In some cases, hæmorrhage, an increasing hæmatoma, infection, and, very rarely, acute cardiac symptoms make it necessary to operate soon after the injury. Under such conditions, there is no choice. Reid believes that, when possible, operation should be postponed for at least six months following the injury. An exception may be made in cases of pulsating exophthalmos in which the eyesight might be endangered by the protrusion.

The advantages of delaying operation are as follows:

1. A good collateral circulation develops which permits excision of the fistula without danger of gangrene.

2. The vessels injured become thoroughly healed, and therefore their dissection becomes easier and safer, especially when a tourniquet cannot be used.

3. Infection of the wound is less likely to occur after the hæmatoma has become absorbed and the tissues have returned to normal.

4. The initial loss of blood at the time of the injury becomes fully restored.

5. In some cases spontaneous healing will occur during the first six months, especially if the patient and the part are put at rest.

6. The ill effects of some arteriovenous aneurisms, particularly those in the upper extremities, may become so mild that operative treatment is rendered unnecessary.

The operative treatment of arteriovenous aneurisms is discussed under the following headings: (1) proximal ligation of the arteries; (2) ligation of the artery proximal and distal to the fistula; (3) ligatures of the vein; (4) quadruple ligation; (5) ligation of the canal of communication; (6) restoration of the continuity of the vessels by lateral or end-to-end suture, and (7) extirpation.

Proximal ligation of the artery has for a century been condemned by surgeons competent to give an opinion, but has not been entirely abandoned. Even at the present time, reports of cases so treated are occasionally published.

Ligation of the artery proximal and distal to the fistula, though much less dangerous than simple proximal ligation, has the same faults. Intermediate branches may keep the fistula open and shunt the arterial blood into the veins without forcing it through the capillaries. It should not be used when it can be avoided.

Ligatures of the vein have rarely been employed alone.

Quadruple ligation has been widely employed and has yielded very good results. It was used a great deal during the World War. It is obvious that all branches arising from the fistula-bearing segment of vessels included between the four ligatures should be ligated if possible.

Ligation of the canal of communication is rarely possible and is open to the objection that the artery at the site of the fistula or in the diseased proximal portion may develop a true aneurism. It is doubtful whether this procedure should be employed even when it is possible.

Restoration of the continuity of the vessels by lateral or end-to-end suture has been employed mainly in cases of very recent origin. Though this operation is probably not necessary in early cases if both artery and vein are tied, it is not open to much objection. In old cases, Reid's clinical and experimental work do not seem to justify restoration of the vessels. The development of an abundant collateral blood supply makes the operation unnecessary. It is doubtful whether the badly degenerated artery should be restored to normal function. The danger of the formation of blood and air emboli when these large dilated vessels are opened and restored under a tourniquet is a real danger. Even when the artery is restored, it is doubtful whether the vein should be restored under any circumstances.

The results of extirpation have been so good that Reid believes it should be regarded as the procedure of choice in old cases and probably also in recent cases.

In some instances the location of the aneurism makes it obviously unwise, if not impossible, to attempt extirpation. Intracranial aneurisms, particularly anastomoses between the internal carotid artery and the cavernous sinus leading to pulsating exophthalmos, belong in this group. By all procedures, about 50 per cent of such cases have been cured, and 20 per cent have been benefited. Undoubtedly, most of the cures have been the result of a thrombosis at the site of the fistula. A new procedure employed in two cases reported consisted in the complete ligation of the external carotid artery by a heavy silk ligature and of the common carotid by a metallic band. Simultaneous ligation of the internal jugular vein is also advised. Ligation of both external and internal carotid areries would check the arterial circulation as effectively as the method advocated, but the latter procedure is better because the internal carotid is a little more difficult to isolate than is the common carotid, and in case cerebral disturbances develop a band can be removed more easily from the common than from the internal carotid artery.

The lesson to be learned from this study of cirsoid aneurisms is that they should be excised early, before the arteriovenous anastomoses have led to such formidable vascular changes that excision becomes very dangerous or even impossible.

There is now considerable clinical evidence for the belief that in operations on large arteries the attempt should be made to establish a circulatory balance in the parts supplied by those arteries by treating the veins similarly to the arteries. This principle is applicable especially to the treatment of arteriovenous aneurisms in which the venous bed becomes enormously dilated as the result of the fistula. In such cases, it may be learned that it is advisable to excise other veins as well as the vein corresponding to the excised artery.

No operations require a more rigid technique than those for aneurisms. The operative procedures are often very long and the consequences of infection are disastrous. Most careful cleansing of the skin, gentle handling of the tissues, and absolute hæmostasis are essential. In addition, the author has usually protected the wound from the skin by covering the field of operation with collodionized China silk. Frequently, elevation of the field of operation, particularly in cases of angiomata and cirsoid aneurisms, is helpful as it lessens the tendency to bleed.

In all of his operations the author has employed silk for the ligatures and sutures because it is safer and less irritating to the wounds than catgut.

The method by which an arteriovenous aneurism is approached depends upon its position. When the operation can be performed under a tourniquet, immediate exposure of the fistula by incision through the venous or arterial wall or an intermediate aneurismal sac will greatly facilitate the operation.

In the postoperative treatment it is important to elevate the limb, apply heat, and use frequent gentle massage directed toward the heart.

The author's conclusions are summarized as follows:

1. Arteriovenous aneurisms occasionally heal spontaneously and cirsoid aneurisms rarely heal spontaneously.

2. When it is possible to wait, arteriovenous aneurisms should not be operated upon earlier than from three to six months after the injury. In this time, healing may occur and an abundant collateral circulation will develop.

3. Cirsoid aneurisms should be treated as soon as a diagnosis is made.

4. In general, extirpation of the involved vessels yields the best results in the treatment of abnormal arteriovenous communications—arteriovenous aneurisms, cirsoid aneurisms, and angiomata This procedure is preferable to all others when an arteriovenous aneurism has been present for any length of time, but in very early cases restoration of both vessels or of the artery, when possible, may be desirable.

5. In cases of pulsating exophthalmos, the external carotid artery should be ligated and the common carotid occluded by a band. It is probable also that the internal jugular vein should be ligated, though this has not generally been done.

6. In all operations on large arteries, an effort should be made to establish a normal vascular equilibrium in the part supplied by those vessels. This

probably means that when a large artery is tied, the accompanying vein should also be ligated.

The article is supplemented by several illustrations. CARL R. STEINKE, M.D.

Colt, G. H., Marshall, C. J., and Wakeley, C. P. G.: Three Cases of Aneurism Treated by Wiring. *Brit. J. Surg.*, 1925, xiii, 109.

The authors report three cases of aneurism of the aorta which were treated by wiring by the Colt method. These cases represent a continuation of the series of sixteen cases previously reported in the *British Journal of Surgery*.

The first case, which is reported by Colt, was a case of aneurism of the abdominal aorta in which death occurred from acute dilatation of the stomach eight days after the operation. At autopsy the sac was found to be completely filled with a recent firm clot in which the wisp of wire lay expanded equally. There was no thrombosis or embolism of the mesenteric vessels. Colt believes that if the patient had survived the acute dilatation of the stomach he would have been cured of the aneurism.

Marshall reports a case of abdominal aneurism in which wiring was done but the apparatus was defective, the cartridge jammed in the cannula, and it was necessary to introduce the wisp wrong end first. As a result, defective expansion of the wisp occurred. The operation was repeated a month later, but death occurred after twelve days. Autopsy showed that death was due to acute dilatation of the stomach and duodenum. Both wisps were embedded in a large recent clot which almost filled the sac. There was no rupture at the site of puncture.

Wakeley reports a case of aneurism of the ascending aorta in which four wisps were introduced in three operations, but death occurred eight and one-half months after the first operation.

Colt cites also two other cases. In calling attention to the frequency with which death is due to acute dilatation of the stomach, he states that when the sac lies in proximity to the cœliac axis gastroenterostomy should be done at the time of the operation on the aneurism.

It has been proved that in a saccular aneurism the dull-gilt wisp is sufficient to initiate active clotting without electrolysis and it is unlikely to project through the opening of the sac. The wires appear to cause no trouble even after many years.

LEO M. ZIMMERMAN, M.D.

Buerger, L.: The Symptomatology of the Diseases of the Vessels of the Extremities in the Light of Their Pathology. *Ann. Clin. Med.*, 1925, iv, 54.

Vascular disorders are grouped into two main divisions: (1) those dependent upon organic local disease of the vessels, and (2) those attributable to neurogenic forces, the blood vessels being practically healthy or completely patent.

The clinical manifestations do not necessarily correspond to the condition of the vessels. The disappearance of the arterial disease with subsidence of all active inflammation may be associated with impairment of the circulation so extensive that it eventually produces gangrene.

Inflammatory arterial affections may show two stages, namely, the acute inflammatory stage and the healed or chronic obliterative stage. In the early stages the symptoms may be obscure for months or even years. They may consist in shooting pain in the calf or leg, difficulty in walking, and possibly tenderness in the calf muscles which may be ascribed to some other condition.

In organic vascular diseases manifestations of impoverishment of the circulation may be of a hydrostatic, mechanical, or vasomotor nature.

The principal symptoms of impairment of the circulation are usually the results of organic vascular disease.

Intermittent claudication is a combination of symptoms, viz., complete or almost complete absence of pain in the limb at rest but cramp-like pain and paræsthesia on movement, weakness shortly after walking is begun, and a gradual increase in these symptoms until in many cases motion is almost impossible. When such symptoms are attended by the disappearance of pulsations in some of the important arteries of an extremity the syndrome is almost positive evidence of an occlusive lesion. Among the conditions which may cause such a syndrome as intermittent claudication are arteriosclerosis, thrombosis, embolism, injury to a main arterial trunk, aneurism, syphilis, acute arteritis, and thrombo-angeitis.

Ischæmia may be either mechanical or hydrostatic and vasomotor. Rubor and erythromelia may be of the inflammatory, intrinsic, or vasomotor variety. They are evidence of defective circulation in the deeper vessels.

Another sign of occlusive arterial disease is cyanosis or lividity of the limb. If this is limited to one toe and is persistent, it is frequently the precursor of death of the tissue.

Paroxysmal pain is usually referable to a vasomotor neurosis, but pain is common in both general classes of circulatory diseases.

The absence of arterial pulsations over a considerable period of observation is usually pathognomonic of obturation of the arteries.

The sudden development of thrombosis may convert a latent unrecognized lesion into one with acute and unmistakable manifestations.

Acute or chronic inflammatory processes may affect any part or all of the coats of the vessel; they may be entirely focal and restricted to small zones, or may attack the entire circumference of the vessel.

Thrombo-angeitis is a definite inflammatory process attacking all of the coats of both the arteries and the veins. It probably bears no causal relation to any simultaneous or previous constitutional ailment. It occurs most frequently in the vessels of the extremities, but the author has seen it in the spermatic vein and the veins of the cord.

Acute arteritis affects either the visceral arteries, the arterioles, or the large arteries such as the aorta and the arteries of the extremities. When it follows acute infections it is usually limited; beginning in the media, but later involving all of the coats.

Although occlusive thrombotic lesions are usually secondary to changes in the vessel walls, emboli may close healthy vessels and produce secondary changes in the vessel walls.

In organic vascular disease it is necessary to differentiate between the symptoms referable to the malady itself and those attributable to the impoverishment of the circulation due to the vascular occlusion. The fact must be recognized that the clinical picture depends to a large extent on the degree of occlusion and the collateral circulation. An acute arteritis from whatever cause is usually of limited extent and comparatively short duration.

Although the first signs to be recognized by the physician in obliterative lesions in the extremities may be trophic lesions and gangrene, there is frequently a history of long-standing difficulty in walking and of aches, cramping, coldness of the peripheral parts, and intermittent claudication. Early recognition of these primary symptoms is of the greatest importance. HAROLD M. CAMP, M.D.

Torell, B.: Three Cases of Embolectomy. *Acta chirurg. Scand.*, 1925, lix, 171.

The first case of embolectomy reported in this article was that of a 52-year-old woman with heart disease and an embolus in the left superficial femoral artery. An interesting feature of the case was that the passage of the embolus from the heart to the femoral artery could be traced. It stopped for a short time at the aortic arch and again at the bifurcation of the aorta. The patient complained of a sensation of heat, at first throughout the body and then limited to the legs.

Prior to the operation the left leg and foot were anæmic, but after the embolectomy the leg again became warm as far as the foot. Subsequently a low amputation of the leg was necessitated by gangrene of the foot. At the time of the amputation a small embolus was found in the anterior tibial artery. The author therefore concludes that the gangrene may have been due to the presence of small emboli in the tibial arteries.

The second case was that of an 82-year-old woman with heart disease (arteriosclerosis or chronic myocarditis) and hemiplegia who was operated upon five hours after the onset of symptoms. She withstood the operation well, was relieved of pain, and was probably saved from gangrene.

The third case was that of a 77-year-old woman who had had an embolus in the femoral artery for four and a half days. An attempt at embolectomy was unsuccessful, and the patient died five days later.

At the postmortem examination an embolus that had not been diagnosed was found in the deep femoral artery.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Davidson, E. C.: Tannic Acid in the Treatment of Burns. *Surg., Gynec. & Obst.*, 1925, xli, 202.

The reaction of the body to a burn strongly resembles the clinical condition described by the term "toxæmia." Many authorities state that the extent of the burned area is of more importance than its depth. A burn of mild degree may be fatal if the area affected is more than one-third of the total body surface.

The theories which have been evolved to explain the alarming symptoms which follow burns may be classified into three groups: (1) those attributing the symptoms chiefly to interference with the normal functions of the skin; (2) those attributing the effects to changes in the blood resulting in altered function; and (3) those explaining the symptoms on the basis of the absorption of a toxic substance from the blood.

The theory which is most strongly supported by available evidence attributes the constitutional reaction to the absorption of a toxic substance from the burned area. The most rational method of combating this toxæmia would be some form of local treatment which would prevent the absorption of the autolytic products of protein decomposition. This might be accomplished by arresting the autolytic process; by removing the products of decomposition mechanically or by baths; by slowing the process of absorption by the use of vasoconstrictor drugs; and by causing the local coagulation of all devitalized tissues.

Tannic acid is a non-nitrogenous amorphous powder which is readily soluble in water and when applied to a burned surface in dilute solution precipitates proteins, thereby apparently preventing penetration into the deeper lying protoplasm. Its true astringent effect appears to be limited exclusively to the most superficial layers of the tissue. The precipitated proteins provide a protective coating against chemical, bacterial, and mechanical action as well as against sensory and inflammatory irritation. Picric acid has some of the properties of tannic acid, but its coagulant action is not marked in the concentrations in which it is used and toxic symptoms are not infrequently observed following its application to extensive areas.

In the author's cases the patient is given a hypodermic injection of ¼ gr. of morphine to alleviate the intense pain, and the burned area is covered with dry sterile dressings and bandages. The dressings are then soaked with a 2½ per cent aqueous solution of tannic acid. It is essential that the tannic acid solution be made up fresh just before its use because it deteriorates upon standing, with the formation of the less astringent gallic acid. Small sections of the dressing are opened for inspection at the end of twelve, eighteen, and twenty-four hours, and as soon as the part is found to have assumed a light brown color, all dressings are removed. This is done best by again soaking the gauze in fresh tannic acid solution.

The wound is thereafter left exposed to the air but is carefully protected from mechanical injury, chilling, and bacterial invasion by a suitable cradle. Around the eyes where the astringent solution cannot be used with entire safety a 5 per cent tannic acid ointment is applied.

After the coagulation of the devitalized tissue with tannic acid, the application of a wet boric acid dressing apparently causes a return of toxic symptoms.

One of the most essential features in the management of all burn cases is the maintenance of the fluid balance of the body. Fluids should be forced by mouth, per rectum, by hypodermoclysis, or by intravenous infusion, according to the indications in the particular case.

A series of cases treated by the method described showed less toxæmia than similar cases treated by other methods. The toxic material of the burned tissue is precipitated by the tannic acid while local tissue dehydration, produced by direct exposure to the air, prevents loss of body water and keeps the toxic material out of solution. The analgesia produced by the tannic acid is one of its most striking effects. Narcotics are seldom necessary after the first injection upon the patient's admission to the hospital.

In non-fatal burns the most distressing feature is usually the scar formation. Under the treatment described, scar formation has been markedly reduced by a decrease in the incidence of infection and the amount of irregular granulation formation and by the formation of a superficial crust which acts as a bridge for the spread of new epithelium over the burned area. CYRIL J. GLASPEL, M.D.

Coller, F. A.: The Use of Paraffin as a Primary Dressing for Skin Grafts. *Surg., Gynec. & Obst.*, 1925, xli, 221.

The Ollier-Thiersch skin graft is used to cover granulating wounds of traumatic or surgical origin. fresh traumatic or operative skin defects, and ulcers of various types. It is easy to apply and its results are fairly sure. The best results are obtained by applying the graft to normal tissue rather than to a bed of scar tissue. Therefore, whenever possible, old granulating areas to be covered are excised and the graft is applied to the more nearly normal underlying tissue.

Complete sterilization of the wound is desirable, but in chronic cases is difficult to obtain. The surfaces can be roughly tested by discontinuing the antiseptic and covering them with dry gauze for twenty-four hours; observation of the amount and character of the exudate will then give an idea of what will happen when the graft is applied. In the presence of sepsis the percentage of successful results is much smaller than when sepsis is absent.

Isografts, even when the donor belongs to compatible blood groups, have given uniformly poor results. Therefore autografts are always employed. With the use of isografts a sudden reaction occurs, causing immediate disappearance of the graft, or an apparent take is followed in several weeks by loss of the graft by disintegration.

Whenever possible, Coller takes his grafts from the patient's right thigh, cutting each one the size of the area to be covered. Before the graft is cut the skin is either moistened with normal salt solution or lightly greased with thin petrolatum. A large broad-bladed amputation knife is used, and as soon as the graft is cut it is covered with a strip of gutta percha. The outer aspect of the graft will adhere to the gutta percha so that when the gutta percha is picked up it will carry the graft with it. The surface to be covered is dried as much as possible, and in a fresh wound care is taken to obtain perfect hæmostasis. The grafts are placed so that they overlap at their point of juncture and overlap the margins of the wound. They are then carefully dried of all gross moisture.

Flexible paraffin of the type used in treating burns is applied by means of an atomizer, the entire grafted area and a margin of skin at its periphery being covered with a layer at least 1.5 mm. thick. The entire paraffined grafted area is then covered with strips of gutta percha each an inch wide and as long as the wound, and over these is placed a dressing of fluff gauze. A retention bandage is applied so that it produces moderate pressure. A coating of paraffin is applied also to the area from which the grafts were removed.

When the grafts are applied to a sterile fresh surface the dressing need not be taken down for at least five days, but in dealing with a granulating surface the first postoperative dressing is done on the third day. If the surface is dry and sterile, a similar dressing is applied and subsequent dressings are done every second day. If infection is believed to be present, the wound is cleaned with Dakin's solution, dried, and exposed to the air under a screen cradle during the day and covered with sterile petrolatum and gauze during the night, the use of paraffin being discontinued.

The paraffin dressing is valuable because it fixes the graft at a time when a slip means disaster, its splinting effect insures the application of a correct amount of pressure without the danger of displacing the graft, and when the time arrives for its removal it comes away freely without any tendency to stick and loosen the graft.

The chief argument against the use of paraffin is that it seals the wound, causing the retention of secretion which will elevate the graft, but the author has not found this true of paraffin as often as of other impervious substances.

CYRIL J. GLASPEL, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Groedel, F. M., Liniger, H., and Lossen, H.: A Collection of Material for the Study of Accidents and Injuries in Roentgen-Ray Work (Materialiensammlung der Unfaelle und Schaeden in Roentgenbetrieben). *Fortschr. a. d. Geb. d. Roentgenstrahlen*, 1925, xxxvi, 1.

The authors state that one of the best methods of decreasing the number of roentgen injuries is the study of cases reported in the records of courts and insurance companies. By such a study it may be learned how such accidents may be avoided.

In eighty-two cases collected by the authors there were ten deaths and five amputations. In all, there had been trouble extending over a period of years. Most of the injuries could have been avoided if the physicians and their assistants had been better trained, if they had been aware of the dangers associated with the treatment, if they had measured the dosage with good instruments, and if, in general, they had gone about the work more carefully, particularly with regard to filter control.

A study of cases of roentgen injury is of value to every physician using the roentgen rays or having it used in his practice.

At the end of the article the authors give suggestions regarding governmental licensing of institutes for medical X-ray work and X-ray workers and regarding improvement of the instruction of students. They ask three years of training for the roentgenologist. They give also the recommendations made by the German Roentgen Society and suggest a questionnaire for insurance for roentgen injuries.

GRASHEY (Z).

RADIUM

Heublein, A. C., and Quick, D.: A Preliminary Report on the Use of an Absorbable Filter with Bare Tubes of Radium Emanation. *Am. J. Roentgenol.*, 1925, xiv, 116.

Radiologists seem to agree that the interstitial method of implanting bare tubes of radium emanation is the best one at their command. Its advantages are it is simple and accurate, it gives even distribution of the radiation, and it allows prolonged irradiation with minimal trauma. Its disadvantages are that occasionally it causes neuritis, hæmorrhage, bone necrosis, or perforation of a hollow viscus even in clean cases, and if pyogenic organisms are introduced infection produces sloughing with pain and occasionally toxæmia and hæmorrhage.

In certain conditions standard element needles and the finer platinum needles employed by Regaud are suitable. The authors attempted to use an absorbable material to filter out the soft beta rays. At first barium was employed, but later bismuth subcarbonate or subnitrate in 33 and 50 per cent preparations was substituted.

For the introduction of the filtration material a needle was loaded with the bismuth by means of a grease gun, the bare tubes were inserted into the middle of the bismuth, and both were injected with the obturator as is done with the bare tube alone. From ⅓ to ½ gr. of the salt was injected with each tube, the amount depending upon the size of the needle used.

In forty-five carcinomata treated in this manner the amount of slough seemed to be materially reduced.

In summarizing, the authors state that this is only a first attempt to improve the technique of the implantation of radium emanation.

A. J. LARKIN, M.D.

MISCELLANEOUS

Eidinow, A.: Some Observations on the Dosage of Ultraviolet Rays in Artificial Sun Treatment. *Lancet*, 1925, ccix, 317.

By means of the acetone methylene-blue light gauge, Hill has shown that there is a great variation in the intensity of the ultraviolet rays in sunlight at different times of the day and in different regions and from different types of sun lamps. Therefore it is difficult to compare the results obtained at different clinics.

It has been proved conclusively that the ultraviolet rays that produce sunburn possess a very great therapeutic value, but because of variations in the sensibility of different persons to light it is impossible to fix a standard dose.

The methods of measuring dosage used are: (1) biological standardization of the sources of the light; (2) tests of the sensitiveness of the skin to the light; and (3) determinations of the effect of a test dose of the light on the bactericidal powers of the blood.

In a study of 125 cases it was found that a mild erythema of the skin after radiation is usually associated with an increase in the bactericidal power of the blood.

The erythemas produced by light may be roughly classified as follows:

1. Erythema that is just visible and usually disappears in one or two days without any sequelæ.

2. Erythema which is readily perceptible, which is followed in three or four days by a fine desquamation, and which ends in a faint pigmentation.

3. Erythema characterized by a violent bluish flush, tenderness, heat, slight œdema, elevation of the hair follicles and massive desquamation and resulting in a deep persistent pigmentation.

4. Erythema causing great pain and resulting in blistering and its sequelæ.

Excessive dosage with light has been shown to produce a very marked decrease in the bactericidal power of the blood. Prolonged exposure to an arc lamp increases the risk of overheating the body by the luminous rays. Many patients who are sensitive to light experience headache, sickness, and dizziness on exposure to light. It is very difficult to determine whether the sensitiveness is due to the ultraviolet or the luminous heat rays. Persons so affected usually appear to tolerate the mercury vapor lamp better than the arc lamp.

The fact that pigmentation can be produced by means of heat rays suggests that it is not specific to the biological action of light. Since it is more apparent following radiation by the warm sun and prolonged exposure to arc lamps, it appears to be closely allied to the heat and luminous rays.

As the degree of pigmentation increases, the sensitiveness to ultraviolet radiation usually diminishes and the light dosage must be increased. As an erythema of the skin produced by light gives rise to increased bactericidal function, it is best to use a scheme of dosage which results in a definite erythema and the slow production of pigmentation. This can usually be achieved by using a very great intensity of ultraviolet energy and preventing the overheating of the body by employing a short and intense dosage.

LLEWELLYN R. LEWIS, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Gye, W. E.: The Etiology of Malignant New Growths. *Lancet*, 1925, ccix, 109.
Barnard, J. E.: The Microscopical Examination of Filterable Viruses Associated with Malignant New Growths. *Lancet*, 1925, ccix, 117.

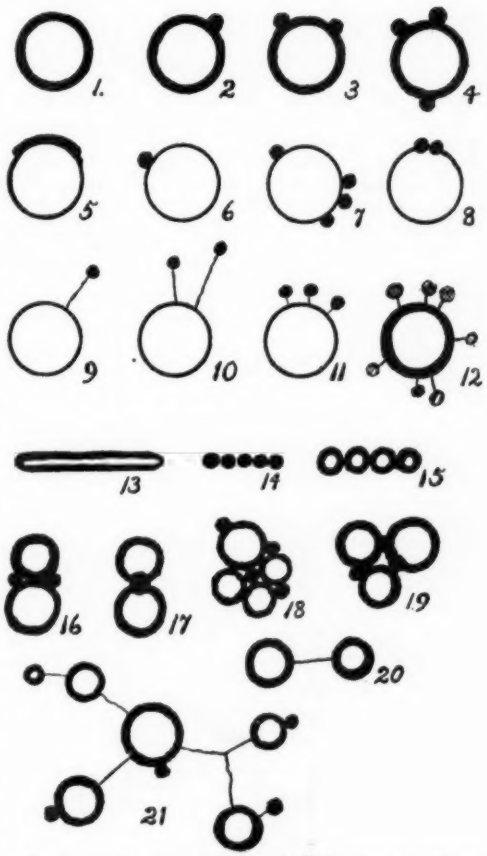
GYE takes as the basis for his report the experiments of Rous who in 1911 and 1914 described a hen sarcoma which could be transferred from one fowl to another by inoculation with dead cells or a cell-free Berkefeld filtrate. Rous described three types of tumors—all sarcomata and all occurring in hens. He did not determine the nature of the filterable agent, but brought forth strong evidence that it was an extremely small microbe. Experiments made by Gye have shown that two factors are necessary to produce a tumor: (1) a filterable agent, probably a virus, and (2) a chemical substance. Neither of these factors operating alone will cause a sarcoma.

Tumors similar in structure to the spindle-cell sarcoma described by Rous can now be produced in chickens by the use of the specific factor of the chicken sarcoma together with cultures from rat tumors. The same is true of mouse tumors. It has been shown also that the non-specific factor can be obtained from human breast carcinoma.

The author concludes that the common factor of these tumors is almost certainly a virus, but that a second specific, obtained from tumor extracts, ruptures the cell defenses and enables the virus to infect. Under natural conditions, continued irritation of the tissues sets up a state under which infection can occur.

BARNARD states that the smallest organism known to grow under ordinary routine methods of cultivation is that of bovine pleuropneumonia. Efforts have been made to improve the microscope for the study of this organism, but in order to obtain an instrument which would be of value in a search for a filterable virus of still smaller size it was first necessary to improve the mechanical and optical parts of the microscope. Barnard devotes the first part of his article to a description of the instrument used in his study.

The investigations reported were made with the use of a double purpose illuminator, a quartz condenser through which ultraviolet light was passed, and an annular glass reflector for the dark ground illumination. Until Gye successfully cultivated the Rous fowl sarcoma, the existence of a filter-passing virus was not recognized. By most careful study, Barnard found a "particulate form which is accompanied by, and is dependent for its reproduction on, a larger spheroidal body which develops from the particulate form and which then forms the host on which the particulate form can develop further."



Diagrammatic representation of bodies seen in cultures of bovine pleuropneumonia.

The accompanying figure shows how the bovine pleuropneumonia organism divides, and appears to explain how subdivision takes place in the smaller micro-organisms. After about twenty hours a tube that has been inoculated from an agar surface colony will show a number of spheroids such as that represented by No. 1. A few hours later, a small refractile dot will be seen on one part of the spheroid, as in No. 2. Later, other bodies develop as in Nos. 3 and 4.

Some spheroids appear to have a thickened wall, while others are thin and of low visibility, but recent observations suggest that the apparent thickening is due to a number of particulate bodies below the limits of size that can be visually resolved. The attached particle tends to move away from the spheroid but remains attached to it. Ultraviolet photographs show its attachment to be a fine filament which is derived from the spheroid and gives to the latter an amœboid appearance.

Some particles soon develop into small spheroids and form groups, as in Nos. 16, 17, 18, and 19, each of them developing attached particles substantially as shown. In most cases, however, the spheroid tends to disintegrate or at least to become less visible, and finally reaches an unstable physical state, somewhat as shown in Nos. 12 and 21, in which the central spheroid is still evident but is surrounded by a number of smaller spheroidal bodies. This formation is quite characteristic, but can be appreciated only when it is seen under the microscope.

An interesting physical phenomenon is the grouping and movement in fluid, in which a rotating spheroidal body unevenly loaded with particles appears to assume a form suggesting a spiral disposition.

That the particles can and do develop into spheroids has been proved by careful filtration experiments. The explanation of the life cycle may therefore be that the spheroids take the place of the living cells in providing conditions suitable for reproduction.

A long series of comparative observations on cultures, all of which have ultimately been proved by animal experiments to be infective, has led to the conclusion that the same type of phenomenon on a smaller scale is to be observed in the Rous fowl sarcoma, the mouse sarcoma, and later in human sarcoma as is seen in cultures of bovine pleuropneumonia. PAUL W. SWEET, M.D.

Carrel, A.: The Mechanism of the Formation and Growth of Malignant Tumors. *Ann. Surg.*, 1925, lxxxii, 1.

Carrel believes that the problem of cancer must be studied from its physiological side. Clinical observation has shown that tumors occur at the site of chronic irritation. Experimental evidence suggests that the irritant in cancer production need not be specific. Repeated applications of coal tar to the skin of white mice leads to the formation of cancer as well as chronic irritation of parasitic or bacterial origin.

Carrel has approached the subject by an intensive study of the Rous sarcoma of the chicken. This sarcoma is readily produced in normal chickens by the inoculation of a few drops of a Berkefeld filtrate of ground-up tumor tissue. Hence it is certain that the virus or active agent which transmits the Rous sarcoma must be a living, filtrable microorganism or a filtrable chemical agent.

In cultures of fragments of the Rous sarcoma *in vitro*, two types of cells predominate. These are fibroblasts and large mononuclear leucocytes or monocytes. The fibroblasts were found not to be malignant, whereas a pure culture of the monocytes, when inoculated with a small amount of filtered tumor extract, into normal chickens, propagated the virus and transmitted the sarcoma. It appears that the macrophages propagate the virus and transmit the disease. Carrel has found that a pure culture of the white blood corpuscles from normal hens can be transformed into malignant monocytes by the addition of a small amount of the Berkefeld filtrate.

This description of the mechanism of tumor formation and growth is probably not an accurate expression of the complete phenomena involved in tumor genesis. The author believes that the filtrable agent which is responsible for the growth of the Rous sarcoma is probably not a living virus, but a chemical which has a specific affinity for the white blood corpuscles of the host. It is readily propagated by the monocytes and leads to their early death. Other normal white blood corpuscles are attracted to the site of inoculation and, becoming diseased, die early and further propagate the agent.

Gye, working in London in the National Cancer Research Laboratory, has recently found that the Rous sarcoma is caused by a filtrable micro-organism which he has been able to culture and with which he has been able to produce new tumors in normal chickens. JOHN W. NUZUM, M.D.

Horsley, J. S.: The Transplantation of Distant Skin Flaps for the Cure of Intractable Basal-Cell Carcinoma. *Ann. Surg.*, 1925, lxxxii, 14.

To two cases he reported previously Horsley adds eight others of basal-cell cancer which were operated upon by the transplantation of distant skin flaps.

Skin cancers may be divided into two large groups, those of the spinous-cell type and those of the basal-cell type. Spinous-cell cancers form metastases with great regularity, whereas basal-cell cancers rarely metastasize. Only about seven cases of basal-cell cancer with metastases have been reported in the literature.

It seems probable that during the growth of a basal-cell cancer some product is elaborated which breaks down the resistance of the adjacent tissues and promotes the growth of the cancer. Acting on this hypothesis, the author includes in his treatment of intractable basal-cell cancer the transplantation of a flap taken at a distance which will insure normal resistance of the tissue.

In the early stages, all basal-cell cancers are amenable to treatment. The knife, the cautery, pastes, radium, and the roentgen ray are usually effective. The surface of the cancer should be well cauterized with the electric cautery, the excision should be made either with the cautery or with the knife and the raw surface should be cauterized immediately.

If more rapid healing is desired, the burnt surface can be dissected off with a sharp knife, leaving a wound ready to receive a graft. When it seems advisable to excise the burnt surface it would be well to postpone the transplantation of the graft for a week or two until the cauterized area has formed granulation tissue.

In none of the author's cases in which the flap was taken from a distance of an inch or more has there been a recurrence along the margin of, or within, the transplanted tissue.

JOHN W. NUZUM, M.D.

Opitz: On the Radiation Biology of Carcinoma. *Brit. J. Radiol.*, 1925, xxx, 252.

The majority of investigators believe that the effect of the roentgen rays and radium on cancer is due essentially to their destructive action upon the cells. Biological incidents they regard as of secondary importance. The author believes that this hypothesis is proved untenable by the following observations:

1. After heavy doses of radiation exceeding the so-called carcinoma dose, a number of living and growing cancer cells are frequently observed in the connective tissue which has been destroyed by irradiation.

2. Improvements in the condition or even cures of cancer frequently occur from doses which, according to the customary view, must have been inefficacious.

3. Cancers of different origin behave in extraordinarily different ways in reaction to the rays, and the patient's general condition materially influences his radiosensitivity.

4. The variability of reported results obtained with prophylactic after-irradiation of mammary cancer with different doses are not reconcilable with a direct destructive action.

5. The histologically recognizable changes which occur after irradiation show, at least in experiments on animals, that the changes in the tumor swellings precede those of the epithelial cells.

6. The effect of the roentgen rays on implanted tumors is diminished when the dose is raised, doubtless because the recession caused by the changes produced in the connective tissue by irradiation occurs more quickly as the strength of the radiations becomes greater.

7. Enlargement of the field of radiation so that not only the tumor but also its environment is reached improves the action of the radiation.

8. Recession, and even a complete cure, of inoculated tumors can be obtained when the whole animal is irradiated and the tumor itself is shielded from the direct action of the rays. The histological changes observable in such cases are in no way different from those occurring when the radiation is direct.

9. Spontaneous cancers in mice treated with soft roentgen rays may be transferred by inoculation with as much success as those which are not irradiated, while the tumor left in its place completely recedes.

10. Research on animals has shown that the dose of radiation necessary to cause regression in cancers is smaller the smaller the tumor.

11. Whether the regression of a tumor obtained by inoculation takes place as the result of irradiation or spontaneously, the histological aspect is invariably the same.

12. The irradiation of cancer cells outside the body does not lead with certainty to the destruction of their reproductivity by grafting, having that effect only when the dose is several times greater than that applicable to cancer cells within the body.

A correct understanding of the problem can be reached only when not only the cancer but also the relation of the entire organism is associated with the phenomena which follow irradiation. Investigations on single cell life are not applicable to multiple cell life. Changes *in vivo* differ markedly from those *in vitro*. Only the mutual action and reaction of every cell and the entire organism can throw light on what takes place biologically when a cancer is subjected to irradiation.

Some of the author's general ideas regarding the biology of cancer are as follows:

Cancer is a superfluous growth of epithelial cells which increase without limit and have the power to penetrate neighboring tissues, but which, on the other hand, are extremely frail structures and therefore fall an easy prey to necrosis and regression. In the connective tissue around the growth a zone of reaction is regularly observed which is characterized by multiplication of the fixed cells and immigration of others, the appearance of capillaries, etc. Hereditary disposition and extrinsic causes play a part in the origin of the lesion, as does also a general change in the bodily condition. It is probable that a local change of chemical constitution occurs and that the normal equilibrium between epithelium and connective tissue is destroyed, making it possible for the former to penetrate the latter.

When an animal organism is treated with radiation two types of effects are clearly distinguishable, a local one on the part struck by the rays, and a general one extending over the entire body. Radium preparations have chiefly a local effect, whereas hard roentgen rays bring the general effect into prominence with the local action. Cancer cells are undoubtedly not destroyed by the doses used but are injured thereby and made more sensitive to other influences. On the application of the properly selected dose a change takes place in the connective tissue in the sense that the already existing changes entailed by the cancer are considerably accentuated. The general effect is manifested by changes in the blood constituents, chemical changes in the blood, and functional changes in the vegetative nerves. These chemical and nervous changes produce effects on the locus of reaction between the cancer and the tissues which are harmful to the cancer.

This effect is ascribable in part to a lymphocytosis created by, or due to, histiocytes. The powers which the body itself exerts against cancer are stimulated and increased by irradiation. The site of the defensive powers is the connective tissue or more exactly the reticulo-endothelial apparatus or organ.

The processes surrounding cancer are believed to be nothing more than a defense reaction due to unlocalized stimulative treatment. If this is correct, two ways lie open for the improvement of radiotherapy: (1) the influencing of the connective tissue by general stimulation of the organism, which may perhaps be still further improved by localized stimulation, and (2) the influencing of the life-nerves and with them the connected blood glands and blood-forming centers in the sense of an indirect stimulation of the reticulo-endothelial apparatus.

In experiments on animals to intensify the effects of radiation by the aid of the vital nerves, complete disappearance of the implanted cancer could be attained quite regularly with fairly small doses of radiation. The specific effects of galvanization, light treatment, heat, diathermy, etc. must be brought into relation with those of roentgen and radium radiation. The matter of radiation dosage requires reviewing, and the idea of a "carcinoma dose" must be eliminated. The problem of irradiation must be based on biology rather than purely physical science. ADOLPH HARTUNG, M.D.

DUCTLESS GLANDS

Brown, L., Vincent, S., Pugh, L., and Others: Special Discussion on Endocrine Therapy. *Proc. Roy. Soc. Med.*, Lond., 1925, xviii, 25.

BROWN: One of the objects of endocrine therapy is the replacement of a deficient internal secretion. In other cases an extract is employed merely for its pharmacological action. Adrenalin, for example, may be used for its local vasoconstrictor effect or its stimulating action on the sympathetic, as in asthma, and pituitrin for its stimulating effect on plain muscle as in paralytic distention of the bowel. In some conditions other drugs are employed which, by their influence on the endocrine glands, enable these glands to carry out their normal function more satisfactorily. Illustrative of this is the use of iodine in diseases of the thyroid.

In the cases of preparations from the thyroid, parathyroid, and anterior pituitary gland, and in the case of insulin, oral administration is effective. With regard to other endocrine glands, it is not known whether the active principle will escape the action of the digestive ferments.

As the pituitary gland is an outgrowth of the nasal mucosa, it is possible that its extracts may be more easily absorbed when they are sprayed into the nose or when plugs of cotton wool soaked in a solution of the extract are inserted high up in the nasal cavity. This method has met with a fair degree of success in the treatment of diabetes insipidus. Some observers have claimed that they have seen effects on the blood pressure after the free application of the drug to the nasal mucosa for its local vasoconstrictor action as a preliminary to operation.

Insulin given in large doses by rectum with blood serum or water is reported to cause a reduction in the blood pressure.

Adrenalin, pituitrin, and insulin produce powerful effects when given by subcutaneous or intravenous injection.

The grafting of endocrine glands is more apt to be successful if the gland is introduced into homologous tissue, such as is the case when a testicular graft is implanted in the testicle. An adrenal graft may take and remain effective in the testis because the interstitial cells of the testes and the cortex of the adrenal have a similar origin.

Loewi's adrenalin eye test, Goetsch's intradermal test, the diastase test, and tests of tolerance to quinine hydrobromide as employed by Bram are probably capable of modification so that they will yield objective evidence of the efficacy of an endocrine preparation. Vines has tested the activity of parathyroid extracts by their power to destroy guanidine, and has determined their therapeutic effect by estimating the calcium content of the blood.

Dixon has shown that the injection of ovarian extract causes an immediate secretion of pituitrin into the cerebrospinal fluid, and Burn has demonstrated that the injection of pituitrin inhibits the fall of blood sugar which would otherwise be produced by insulin. The deduction seems justifiable that an ovarian hormone stimulates the pituitary to antagonize the pancreas.

Allen and Doisy have prepared an ovarian extract which produces the œstrual phenomena in oöphorectomized animals. More recently, Dixon and Marshall have shown that the presence of a corpus luteum of œstrus or pregnancy inhibits the activity of an ovarian extract, but just before parturition begins there appears to be a sudden rush of pituitrin into the cerebrospinal fluid, and on entering the circulation, this helps to empty the uterus and to start the flow of milk.

The antagonism between adrenalin or thyroxin on the one hand and insulin on the other is manifested indirectly through the liver. Adrenalin and thyroxin tend to empty the glycogen reservoirs and to flood the blood with sugar, while insulin checks the conversion of protein and fat into glycogen and increases the process of assimilation of sugar by the tissues.

The effect of insulin on fat metabolism suggests that, in combination with dextrose, insulin might be of value in the treatment of hepatic toxæmias such as the toxæmia which causes post-anæsthetic vomiting. The co-operation between the pancreas and parathyroids is shown by the tendency for glycosuria to appear after parathyroidectomy, and by the calcium drainage resulting from a defect in either of these glands.

The theory of co-operation between the adrenals, thyroid, and pituitary on the one hand and between the pancreas and parathyroids on the other, and of antagonism between these two groups has considerable experimental support, as has also the view that the gonads and the sympathetic nervous system interact with the former.

Adrenalin relieves the asthmatic paroxysm because it dilates the bronchial muscles. The sympathetic has a similar action, thus correcting the disturbance produced by an overacting vagus.

Thyroid has the widest application of all the endocrines. Parathyroid extract can be absorbed from the alimentary tract.

Adrenalin is of little if any use in substitution therapy, but is of great value for its local effect on the blood vessels in local anæsthesia, epistaxis, and gastrostaxis, and for its effect on plain muscle in such conditions as œsophageal spasm and asthma.

Pituitary extract is used as a cardiac stimulant. It is beneficial also in asthma, and occasionally alleviates Froehlich's syndrome and adiposis dolorosa. Injections of pituitary extract are of great value in paralytic distention of the bowel, diabetes insipidus, and hypoglycæmic collapse after an overdose of insulin.

Insulin is of proved value in diabetes.

The existence of an ovarian hormone has been proved.

VINCENT: There are as yet only two true endocrine substitutes, the thyroid and the pancreas, and of these, only one, the thyroid, is known to produce any effect when given by mouth.

Adrenin and preparations made from the posterior lobe of the pituitary body have no effect when administered by mouth.

PUGH: In veterinary practice, pituitary extract is employed largely in obstetrical work. Thyroid extract is used in a variety of conditions. Other hormones have been employed either alone or in mixed preparations

Hypoglycæmic shock is characterized by: (1) pronounced thirst, hunger, and frequent yawning, and, in the cases of animals, continuous licking at the coat, legs, and nostrils; (2) later, continuous chewing movements of jaw with the elimination of very frothy saliva; (3) a subnormal temperature; (4) inco-ordination of movement and subsequent inability to stand; (5) absence of convulsions and excitability; (6) rapid spontaneous recovery in all cases after the recumbent position has been assumed.

GARDINER-HILL: In certain cases of obesity a beneficial effect on both the obesity and the carbohydrate metabolism can be expected from the administration of thyroid and whole-gland pituitary extracts. It is suggested that a combination of these two extracts given together may produce better results than thyroid extract given alone. However, the improvement in the condition is not maintained for any length of time after the treatment is discontinued. Sooner or later the metabolism reverts to its former state, and the patient again gains weight. It seems possible, however, that when once the weight has been reduced, the new level of metabolism might be maintained by decreased doses and by alternating treatment with non-treatment.

The sugar-tolerance curves after treatment seem to show that, when given by mouth, certain preparations of pituitary extract have a definite influence on carbohydrate metabolism but are not effective in reducing obesity.

WALKER: Brown-Séquard reported that when, in experiments on himself, he injected subcutaneously the expressed juice of the testes of dogs and guinea pigs, he experienced such an improvement in his general health that he concluded that testicular extract is dynamogenic and has a stimulating effect on the exhausted central nervous system.

Testicular extract given by the mouth is useless.

The intimate association of the testes with the other members of the endocrine circle permits compensatory changes when the activity of the testis is impaired by vasoligation.

MCDONAGH: Many of the glandular extracts are derivatives of the amino-acids. Though the amino-acid group is the most active, the action of the compound depends upon the way in which this group is checked. Adrenalin is a derivative of the amino-acid tryptophane, in which the action of the amino group is checked in the main by the paraphenolic hydroxyl group. Thyroxin is a derivative of the amino-acid tryptophane in which the action of the amino group is checked in the main by the iodine groups in 4 and 6 positions.

Insulin is probably a derivative of the amino-acid histidine in which one or more of the amino groups are checked in the main by a sulphur group. In other words, a conductor group suffices to check the condenser action of the simple dehydrator adrenalin. A simple dehydrator group is required to check the condenser action of the more powerful substance thyroxin. A powerful dehydrator group is required to check the action of the still more complex substance insulin. Comparing the action of the various groups which occasion condensation of the protein particles, it is found that $NH_2 > S > O > I > Br > Cl$.

Adrenalin causes the protein particles in the plasma to increase in number and then to go into solution. This dual action of conduction and dehyration leads to a constriction of the capillaries which is followed in turn by a rise in the blood pressure. The action of adrenalin is not specific. All drugs exhibiting first a conductor and then a dehydrator action can be used as antidotes in conditions brought about by an increase in size or hydration of the protein particles. Insulin causes hydration of the protein particles and adrenalin proves an "antidote" because it causes dispersion of the hydrated particles.

Thyroxin causes a dehydration of the protein particles, but the process is exhibited more slowly than is the case with adrenalin.

Insulin causes hydration of the protein particles. That is to say, it brings back to the protein nucleus the other constituents, such as electricity, salts,

sugar, amino acids, and fat, which are being detached from the protein nucleus at the bidding of the dehydrator.

McDonagh calls the active principle of the testes "ageratin," a term derived from the Greek "ageratos," meaning not to grow old. This substance prevents a conductor from causing dispersion of the protein particles, histamine from producing shock, and insulin from bringing about a state of hypoglycæmia.

RAY: Besides the well-known reciprocal actions of the ductless glands, their interaction with the nervous system, and their influence on growth, they exert equally well known powerful effects on bodily metabolism. Examples are the control of the assimilation of carbohydrates by the pancreatic tissue and their mobilization by the chromaffin tissue; the influence of the thyroid on protein metabolism and its further influence on glycæmia through its regulating action on pancreatic and chromaffin hormones.

These glands are primarily responsible for what may be termed the make-up of the individual.

In the realms of psychopathology we find that certain Freudian theories can be explained by physical-chemical action. Memory and the material basis of the nervous system may be regarded as manifestations of metabolic activity in which ions, and possibly electrons, play a part. To put it briefly, the individual may be described as the sum of his ductless glands.

A diathesis is therefore not a sharply circumscribed disease picture but a manifold disease tendency dependent upon an altered blood admixture with consequent tissue changes. Its connection with the endocrine system is discussed.

MORRIS H. KAHN, M.D.

BIBLIOGRAPHY *of* CURRENT LITERATURE

NOTE.—THE BOLD FACE FIGURES IN BRACKETS AT THE RIGHT OF A REFERENCE INDICATE THE PAGE OF THIS ISSUE ON WHICH AN ABSTRACT OF THE ARTICLE REFERRED TO MAY BE FOUND.

SURGERY OF THE HEAD AND NECK

Head

Cerebral communications and fractures of the base of the cranium. M. IÑIGO NOUGUÉS. Clin. y lab., 1925, v, 407.

The roentgen recognition of fractures of the base of the skull. E. G. MAYER. Fortschr. a. d. Geb. d. Roentgenstrahlen, 1925, xxxiii, 52.

Osteomyelitis of the skull. H. FLEMING. California & West. Med., 1925, xxiii, 985.

Extraction of a revolver bullet from the prevertebral region after compression of the lateral sinus. LANNOIS and PATEL. Lyon chr., 1925, xxii, 255.

Septic phlebitis or lateral sinus thrombosis of otic origin. W. D. JONES. Texas State J. M., 1925, xxi, 231.

A congenital malformation of the jaw. P. GUILLAUME-LOUIS. Bull. et mém. Soc. nat. de chir., 1925, li, 298.

Micrognathia. E. SEIFERT. Arch. f. klin. Chir., 1925, cxxxv, 726.

Fracture of the inferior maxilla; osteosynthesis with a plate; perfect restoration. BRAU-TAPIE. Bull. et mém. Soc. nat. de chir., 1925, li, 359.

Closed fractures of the condyloid portion of the maxilla. P. KRIVINE. Presse méd., Par., 1925, xxxiii, 618.

Operative reduction of the lower jaw in acromegaly. G. BLESSING and F. ROST. Zentralbl. f. Chir., 1925, lii, 855.

The adamantinoma in its relation to odontogenous tumors of the jaw. J. LUKOMSKY. Arch. f. klin. Chir., 1925, cxxxv, 233.

Adamantine epithelioma of the mandible of ten years duration. BÉRARD and DUNET. Lyon chir., 1925, xxii, 216.

Adamantine epithelioma of the mandible. SANTY. Lyon chir., 1925, xxii, 214.

The use of hook extension in surgery of the jaws. C. BRUHN. Ztschr. f. Stomatol., 1925, xxiii, 214.

Facial development. A. THOMSON. Internat. J. Orthodont., Oral Surg. & Radiography, 1925, xi, 705.

A case of plastic operation of the eyelids. T. GOLDSCHMIDT. Zentralbl. f. Chir., 1925, lii, 688.

Reflex pains about the head and face. M. C. BAKER. Kentucky M. J., 1925, xxiv, 433.

A new technique for the roentgenological examination of the salivary glands. J. P. USLENGHI. Rev. Soc. argent. radio y electrol., 1925, i, 42.

Salivary fistula behind the ear. W. KAUSCH. Zentralbl. f. Chir., 1925, lii, 914.

An analytical study of 100 cases of epithelioma of the lip in relation to the significance of mitosis. B. T. SIMPSON and L. GIBSON. Arch. Clin. Cancer Research, 1925, i, 17.

Eye

Oculists or optometrists—which? J. M. PATTON. J. Am. M. Ass., 1925, lxxxv, 564.

The foundations of vision. SIR J. H. PARSONS. Lancet, 1925, ccix, 123. **[431]**

Observations in the eye clinics of Vienna. E. C. BACH. Wisconsin M. J., 1925, xxiv, 134.

Eye strain. Brit. J. Ophth., 1925, ix, 409.

Industrial eye injuries. R. CALDWELL. South. M. J., 1925, xviii, 619.

The treatment of phlyctenular inflammations of the eye. S. FUNAISHI. Am. J. Ophth., 1925, viii, 618. **[431]**

Syphilitic gumma of the eyelid, case report. E. B. HECKEL and L. G. BEINHAUER. Arch. Ophth., 1925, liv, 352. **[431]**

Trachoma in Rosario de Santa Fé. C. WESKAMP. Rev. méd. d. Rosario, 1925, xv, 80.

The effect of tryparsamide on the optic tract; a clinical study of the subject. E. E. NEFF. Wisconsin M. J., 1925, xxiv, 120.

The Crampton accommodation rod. F. H. ADLER. Am. J. Ophth., 1925, 3 s. viii, 634.

The function of convergence. RIBAS VALERO. Rev. méd. de Sevilla, 1925, xliii, 27.

Ocular manifestations in serum sickness. A. L. BROWN. Am. J. Ophth., 1925, 3 s. viii, 614.

Unilateral nystagmus. L. POST. Am. J. Ophth., 1925, 3 s. viii, 632.

Ocular complications of chorea. H. M. LANGDON. Am. J. Ophth., 1925, 3 s. viii, 626.

Toti's operation for dacryocystitis. V. L. RAIA. Am. J. Ophth., 1925, 3 s. viii, 547. **[431]**

Restoration of the lachrymal passage after excision of the sac; report of a case. J. F. CALLAHAN. Arch. Otolaryngol., 1925, ii, 127.

Primary unilateral diphtheritic conjunctivitis. H. D. FALLOWS. Am. J. Ophth., 1925, 3 s. viii, 635.

Siderosis bulbi. S. B. MUNCASTER. Am. J. Ophth., 1925, 3 s. viii, 630.

Orbital abscess in an infant. W. C. POSEY. Am. J. Ophth., 1925, 3s. viii, 612.

Bony tumors of the orbit. W. L. BENEDICT. Ohio State M. J., 1925, xxi, 557.

Bullous keratitis associated with sinus disease. J. M. GRISCOM. Atlantic M. J., 1925, xxviii, 740.

Prolapse of the iris. A. E. BULSON, JR. J. Am. M. Ass., 1925, lxxxv, 322.

The anatomy of inversion and recession of the iris. A. FUCHS. Am. J. Ophth., 1925, viii, 601. **[432]**

Injuries to the crystalline lens. W. A. HUBER. Am. J. Ophth., 1925, 3 s. viii, 635.

The properties of lens protein. S. R. GIFFORD. J. Am. M. Ass., 1925, lxxxv, 351. **[432]**

The pathology of cataract. H. S. HEDGES. Virginia M. Month., 1925, lii, 275.

The treatment of cataract. J. A. WHITE. Virginia M. Month., 1925, lii, 277.

Cataract, preventable complications at the time of operation and during the healing process. W. A. FISHER. Illinois M. J., 1925, xlviii, 136.

Phacoeresis: observations on the technique, with a report on 115 consecutive cases. M. M. CRUICKSHANK. Brit. J. Ophth., 1925, ix, 321. [432]

Blind spot for achromatic and chromatic stimuli. C. E. FERREE, G. RAND, and H. A. WENTWORTH. Am. J. Ophth., 1925, 3 s. viii, 620.

Diabetic retinitis. H. FRIEDENWALD. J. Am. M. Ass., 1925, lxxxv, 428.

Acute glaucoma. J. J. WYNN. Kentucky M. J., 1925, xxiv, 427.

Cavernous optic atrophy and its relation to glaucoma. R. PICKARD. Brit. J. Ophth., 1925, ix, 385. [432]

Derangements of the organo-vegetative nervous system and of the endocrinian system in essential glaucoma. H. LAGRANGE. Brit. J. Ophth., 1925, ix, 398. [432]

Miscellaneous notes on glaucoma. H. GIFFORD. Arch. Ophth., 1925, liv, 337. [432]

Fundus changes in conditions of intracranial pressure. E. B. HECKEL. Am. J. Ophth., 1925, viii, 639.

A case of neuro-epithelioma. J. J. HORTON. Am. J. Ophth., 1925, 3 s. viii, 637.

Ear

Pathological conditions of the hearing organ, with special reference to the deaf mute. E. AMBERG. J. Michigan State M. Soc., 1925, xxiv, 416.

Otosclerosis: does it exist as a separate disease? R. LAKE. J. Laryngol. & Otol., 1925, xl, 512.

The function of the vestibular organ and the clinical examination of the otolithic apparatus. F. H. QUIX. J. Laryngol. & Otol., 1925, xl, 425, 493. [433]

Spontaneous nystagmus, vestibular and functional hearing test findings as aids in the differential diagnosis of inner ear and eighth nerve affections. G. W. MACKENZIE. Laryngoscope, 1925, xxxv, 611.

How does the caloric nystagmus arise? S. H. MYGIND. J. Laryngol. & Otol., 1925, xl, 444. [433]

Some remarks on labyrinthine surgery. E. B. DENCH. Laryngoscope, 1925, xxxv, 579.

Allergy and its relation to the otolaryngologist. G. PINESS and H. MILLER. California & West. Med., 1925, xxiii, 1014.

A discussion of some of the clinical problems of chronic suppurative otitis media. G. E. SHAMBAUGH. Laryngoscope, 1925, xxxv, 593. [434]

Complications of suppurative inflammation of the middle ear. R. C. SMITH. Wisconsin M. J., 1925, xxiv, 125.

Conservative treatment of chronic suppurative otitis media. J. E. MULSOW. Wisconsin M. J., 1925, xxiv, 130.

The incidence of mastoid disease in the United States. A. BLALOCK. South. M. J., 1925, xviii, 621.

The winter's mastoids. C. H. SMITH. Med. J. & Rec., 1925, cxxii, 128.

Gastro-intestinal disturbances in infants as a result of obscure infection in the mastoid. A. M. ALDEN and H. W. LYMAN. Laryngoscope, 1925, xxxv, 586.

Mastoiditis a cause of gastro-intestinal disturbances in infants. H. W. LYMAN. J. Missouri State M. Ass., 1925, xxii, 293.

A case of acute mastoiditis. E. CASTERÁN. Rev. méd. Lat.-Am., 1925, x, 910.

A new device and technique for making radiographs of the mastoids in the Law and in the Arcelin positions. A. GRANGER. Radiology, 1925, v, 44. [434]

The treatment of election for draining mastoids. F. LAYNA. Pediat. espafi., 1925, xiv, 144.

The mastoid operation. J. FRIEDMAN and S. GREENFIELD. Med. J. & Rec., 1925, cxxii, 204.

The indications for the radical mastoid operation. W. E. GROVE. Wisconsin M. J., 1925, xxiv, 132.

Nose and Sinuses

A rib implant for depressed bridge of the nose. C. M. EADIE. Med. J. Australia, 1925, ii, 137.

A consideration of what may be accomplished through the nasal (sphenopalatine, Meckel's) ganglion in the diagnosis and treatment of certain nasal conditions. A. M. ALDEN. J. Ophth., Otol., & Laryngol., 1925, xxix, 310.

Allergy: a non-surgical disease of the nose and throat. G. PINESS and H. MILLER. J. Am. M. Ass., 1925, lxxxv, 339.

Nasopharyngeal lesions and arthritis. V. K. HART. J. Ophth., Otol. & Laryngol., 1925, xxix, 301.

Ephedrin sulphate, the alkaloid of Ma Huang; the effects of its local application on the nasal mucous membrane; preliminary report. G. FETTEROLF and M. B. SPONSLER. Arch. Otolaryngol., 1925, ii, 132.

The operative treatment of atrophic rhinitis. E. KING. Cincinnati J. M., 1925, vi, 302.

The use of ivory implants for atrophic rhinitis. E. KING. Cincinnati J. M., 1925, vi, 301.

Small perforations of the nasal septum and my method of treatment. J. N. ROY. Arch. Otolaryngol., 1925, ii, 175.

Cavernous sinus thrombosis following submucous resection—case report. J. L. EMENHISER. U. S. Naval M. Bull., 1925, xxiii, 141.

Postoperative management after nasal interventions. C. F. ROLDÁN VERGÉS. Semana méd., 1925, xxxii, 1162.

A nasal tumor, probably of tuberculous origin. N. S. CARRUTHERS. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 54.

Electrocoagulation and radiation therapy in malignant disease of the ear, nose, and throat. G. E. PFAHLER. J. Am. M. Ass., 1925, lxxxv, 344. [434]

The paranasal cavities. H. W. LOEB. Arch. Otolaryngol., 1925, ii, 141.

The X-ray diagnosis of diseases of the nasal accessory sinuses, with special reference to sphenoid and ethmoid diseases. R. A. POWERS. California & West. Med., 1925, xxiii, 1009.

Osteoma of the ethmoid. W. HOWARTH. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 50.

Disease of the anterior ethmoidal cells causing optic neuritis. J. A. GIBB. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 55.

Report of a case of frontal sinusitis complicated with profound syphilis. G. W. MACKENZIE. Am. J. Syphilis, 1925, ix, 479.

Leishmaniosis of the frontal sinus treated with a double iodide of quinine and bismuth. E. ESCOMEL. Crón. méd., Lima, 1925, xlii, 129.

Accessory nasal sinus disease in children. C. A. McWILLIAMS. N. Orleans M. & S. J., 1925, lxxviii, 69.

Paranasal sinusitis in children. W. B. DAVIS. Atlantic M. J., 1925, xxviii, 736. [434]

Paranasal sinus disease in children. L. W. DEAN. J. Am. M. Ass., 1925, lxxxv, 317. [434]

The end-results of sinus surgery in children. J. J. SHEA. Arch. Otolaryngol., 1925, ii, 111. [435]

Hæmatoma of the antrum. M. ROSS. Laryngoscope, 1925, xxxv, 600.

Acute pulmonary infection following operation on the maxillary antrum. D. MCKENZIE. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 50. [435]

Mouth

The treatment of harelip. H. F. MACAULEY. Brit. M. J., 1925, ii, 253.

Lengthening the soft palate in cleft palate operations. G. M. DORRANCE. Ann. Surg., 1925, lxxxii, 208.

Stomatology in relation to internal medicine. A. BASSLER. J. Ophth., Otol., & Laryngol., 1925, xxix, 320.

Stomatology and medical diagnosis. M. J. SYNNOTT. J. Ophth., Otol., & Laryngol., 1925, xxix, 322.

Stomatology and dietetics. A. J. ASGIS. Clin. Med., 1925, xxxii, 530.

Chronic hypertrophic gingivitis. P. BAIOCCHI. Ann. ital. di chir., 1925, iv, 465.

The permeability of enamel. A. LIVINGSTON. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Odontol., 27.

Circulation of lymph in the dentine. E. W. FISH. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Odontol., 35.

Focal infection, a medicodental problem. F. P. WISNER. California & West. Med., 1925, xxiii, 977.

A dental cyst in connection with a deciduous tooth. G. HARBOROW. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Odontol., 33.

Dentigerous cysts and adamantinoma with embryonal teeth. A. MORLET and J. B. MORLET. Presse méd., Par., 1925, xxxiii, 677.

Infectious granulomata from abscessed teeth. E. M. DALAND. Boston M. & S. J., 1925, cxciii, 258.

Suffocation of an infant due to cysts of the tongue. K. LEUW. Schweiz. med. Wchnschr., 1924, liv, 1004.

The nature and etiology of lingual carcinomata, with special reference to the etiological importance of lues. H. SCHLEICHER. Ztschr. f. Krebsforsch., 1925, xxii, 144. **[435]**

Anatomy and technique of conduction anæsthesia in the region of the mouth. H. SICHER. Berlin: Springer, 1925.

Pharynx

The repair of inoperable soft palate. J. E. SHEEHAN. Med. J. & Rec., 1925, cxxii, 185. **[435]**

Septic tonsillitis followed by bilateral acute middle-ear suppuration, acute mastoiditis, acute nephritis, hæmorrhage from the bowel, and secondary anæmia; recovery. E. D. D. DICKSON. J. Laryngol. & Otol., 1925, xl, 530.

The operative treatment of diseased tonsils and adenoids. J. R. GRIFFITH. Practitioner, 1925, cxv, 150.

Tonsillectomy by propulsion and avulsion. J. B. HORGAN. Practitioner, 1925, cxv, 145.

The roentgenographic demonstration of adenoids. C. C. GRANDY. Am. J. Roentgenol., 1925, xiv, 114.

A pharyngeal growth in a man aged 70 years. G. BADGEROW. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 54.

A case of lymphosarcoma of the pharynx and nasopharynx. SIR J. DUNDAS-GRANT. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 51.

Nævus of the epiglottis and tongue. H. KISCH. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 53.

Neck

Fistulæ and congenital cysts of the lateral region of the neck; three cases. R. SIMON, E. STULZ, and R. FONTAINE. Arch. franco-belges de chir., 1925, xxviii, 203.

A case of thyroglossal cyst. A. TWEEDIE. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 53.

An unusual form of inferior thyroid artery. C.-Z. JATZOUTA. Bull. et mém. Soc. anat. de Par., 1925, xcv, 87.

Aberrant thyroid, with a report of two cases. F. E. MCEVOY. Rhode Island M. J., 1925, viii, 123.

The influence of the autonomic nervous system on the function of the thyroid gland. J. H. CRAWFORD and J. N. J. HARTLEY. J. Exper. Med., 1925, xlii, 179. **[436]**

The histological changes in the thyroid gland of the rabbit following lobectomy. J. H. CRAWFORD and J. N. J. HARTLEY. J. Exper. Med., 1925, xlii, 193. **[436]**

Thyroid instability. H. J. ACHARD. Clin. Med., 1925, xxxii, 525.

Some observations of thyroid patients. J. M. EMMETT. Virginia M. Monthly., 1925, lii, 280.

The effect of feeding thyroid gland and iodine preparations to larvæ of frogs. R. H. KAHN. Arch. f. d. ges. Physiol., 1924, ccv, 404.

Basal metabolic rates and their relation to end-results in thyroid disease: a statistical study. S. M. JORDAN. Arch. Surg., 1925, xi, 1. **[436]**

The relationship between the pathological and clinical aspects of the diseases of the thyroid gland. H. C. FALK. Arch. Surg., 1925, xi, 74. **[436]**

The secretion antecedents and mitochondria in pathological thyroids: a theory of the mode of secretion in the thyroid gland. J. A. KEY. Arch. Surg., 1925, xi, 254. **[436]**

A case of adolescent myxœdema accompanied by nephrosis and by tetany of parathyroid origin, treated with thyroid and Collip's parathyroid extract. J. R. DAVIDSON. Canadian M. Ass. J., 1925, xv, 803. **[437]**

Riedel's chronic thyroiditis; with a report of six cases and a contribution to the pathology. A. F. B. SHAW and R. P. SMITH. Brit. J. Surg., 1925, xiii, 93. **[437]**

Goiter. J. OLIVER. Med. Press, 1925, n.s. cxx, 129.

The classification of goiter from the standpoint of the general practitioner. J. H. HUTTON. Chicago M. Rec., 1925, xlvii, 259.

Two contributions with reference to struma. A. TROELL. Arch. f. klin. Chir., 1925, cxxxv, 751.

Endemic goiter, a precancerous lesion. F. A. COLLER and H. B. BARKER. J. Michigan State M. Soc., 1925, xxiv, 413.

Intrathoracic goiter. A. H. NOEHREN. Am. J. Surg., 1925, xxxix, 192.

A case of chylothorax due to compression of the thoracic duct by a substernal goiter. H. SCHULTZE. Wien. klin. Wchnschr., 1925, xxxviii, 455. **[438]**

Gummatous struma. C. H. LASCH. Zentralbl. f. Chir., 1925, lii, 738.

Iodine hyperthyroidism. A. S. JACKSON. Am. J. M. Sc., 1925, clxx, 271.

Psychological factors in hyperthyroidism. N. D. C. LEWIS. Med. J. & Rec., 1925, cxxii, 121.

A suggested analogy between hyperthyroidism and gastric ulcer. G. W. CRILE. Illinois M. J., 1925, xlviii, 109.

A case of delirium associated with the physical signs of exophthalmic goiter; recovery. I. S. SKOTTOWE. Glasgow M. J., 1925, n.s., xxii, 65.

Amphotonia in Basedow's disease and the association of asthma with Basedow's disease. DANIÉLOPOLU. Bull. et mém. Soc. méd. d. hôp. de Par., 1925, 3 s. xli, 234.

Basedow's disease from secondary tumors of the thyroid; observations on metastases of a hypernephroma in the thyroid. H. KLOSE. Arch. f. klin. Chir., 1925, cxxxiv, 439.

The treatment of exophthalmic goiter. E. M. OLIVIERI. Rev. méd. Lat.-Am., 1925, x, 894.

The treatment of Basedow's disease by thyroidectomy. A. KRECKE. Zentralbl. f. Chir., 1925, lii, 866.

The injection of absolute alcohol into the thyroid gland; experimental observation of a suggested clinical procedure. H. B. BARKER. Arch. Surg., 1925, xi, 180.

Improved goiter technique. J. L. DECOURCY. Ann. Surg., 1925, lxxxii, 215.

Variations in the blood sugar in relation to operation on the thyroid gland. C. C. LUND and E. P. RICHARDSON. Arch. Surg., 1925, xi, 171.

Sudden deaths in thyroid surgery. J. J. MALONEY. Cincinnati J. M., 1925, vi, 293.

Dyspnœa following thyroid operations. R. COLP and H. W. LOURIA. Arch. Surg., 1925, xi, 200.

Tetany after goiter operations. O. MAIER. Arch. f. klin. Chir., 1925, cxxxiv, 826.

Thyroid cancer treated by antithyroid serum. AUVRAY and COULAUD. Bull. et mém. Soc. nat. de chir., 1925, li, 348.

Two cases illustrating the comparative failure of ventriculocordectomy for the relief of double abductor paralysis. W. HOWARTH. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 47.

An unusual complication of epidemic meningitis; suppurative arthritis of the crico-arytenoid articulation. J. A. CRUCIANI, and A. SUÁREZ. Semana méd., 1925, xxxii, 1145.

Tuberculous laryngitis from the standpoint of the physician. C. L. LA RUE. Colorado Med., 1925, xxii, 276.

A specimen of the larynx and œsophagus from a case of paralysis of the left recurrent laryngeal nerve and tuberculous ulcers of the œsophagus, all caused by caseous tuberculous glands. H. TILLEY. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 56.

Soft fibromata of the larynx followed by malignant disease. W. H. JEWELL. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 56.

Epithelioma of the right vocal cord. J. A. GIBB. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 55.

A case of epithelioma of the right vocal cord removed by right lateral thyrotomy; recurrence on the left vocal cord removed by left lateral thyrotomy. C. A. S. RIDOUT. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 45.

Abductor paralysis of the right vocal cord subsequent to scirrhous cancer of the left mamma. A. L. TURNER. J. Laryngol. & Otol., 1925, xl, 534.

Laryngeal cancer, its treatment, with special reference to total laryngectomy. F. O. LEWIS. Laryngoscope, 1925, xxxv, 607.

Sarcoma of the larynx. G. WORMS and GRANDCLAUDE. Bull. et mém. Soc. anat. de Par., 1925, xcv, 119.

Economical laryngectomies. P. WINTER. Presse méd., Par., 1925, xxxiii, 666.

SURGERY OF THE NERVOUS SYSTEM

Brain and Its Coverings; Cranial Nerves

A brief discussion of head injuries. C. GILLASPIE. Colorado Med., 1925, xxii, 262.

Chronic intradural hæmorrhage. J. A. CALDWELL. Cincinnati J. M., 1925, vi, 260.

Tuberculosis affecting the optic chiasm, with secondary optic nerve atrophy and retinitis. W. E. GAMBLE and R. C. GAMBLE. J. Am. M. Ass., 1925, lxxxv, 412.

Cerebral abscess of otic origin; trephination; death. CARVASCO. Siglo méd., 1925, lxxii, 531.

Difficulties in the diagnosis of cerebellar abscess. R. S. STEVENSON. Brit. M. J., 1925, ii, 292.

The cerebrospinal fluid as an index of otorhinogenic intracranial complications. C. F. YERGER. J. Am. M. Ass., 1925, lxxxv, 424. **[439]**

Disorders of motility and of muscle tone, with special reference to the corpus striatum. S. A. K. WILSON. Lancet, 1925, ccix, 215, 268.

The amount of cerebrospinal fluid in hydrocephalus; a method for estimation and its clinical application. A. G. MITCHELL and M. ZELIGS. Am. J. Dis. Child., 1925, xxx, 189.

Chronic subdural hæmatoma: Its pathology, relation to pachymeningitis hæmorrhagica, and surgical treatment. T. J. PUTNAM and H. CUSHING. Arch. Surg., 1925, ii, 329. **[439]**

The surgical significance of aneurisms of the brain. M. BORCHARDT. Beitr. z. klin. Chir., 1925, cxxxiii, 429. **[439]**

Intracranial tumors and hydrocephalus. W. E. DANDY. Ann. Surg., 1925, lxxxii, 199. **[440]**

The symptoms and surgical treatment of brain tumors. J. HERTLE and H. ZINGERLE. J. f. Psychol. u. Neurol., 1925, xxxi, 152.

The localization of cerebral tumors by the method of colored intraventricular injections. T. DE MARTEL. Bull. et mém. Soc. nat. de chir., 1925, li, 299.

Medical treatment of pituitary neoplasm. I. H. PARDEE. J. Am. M. Ass., 1925, lxxxv, 513.

The diagnosis of tumors of the temporal lobe. SCHWAB. Deutsche Ztschr. f. Nervenh., 1925, lxxxiv, 38.

An angiomatous sarcoma of the left cerebellopontine angle. MARCHAND and SCHIFF. Bull. et mém. Soc. anat. de Par., 1925, xcv, 63.

Trigeminal neuralgia and its management. D. KULENKAMPFF. Muenchen. med. Wchnschr., 1925, lxxii, 224.

Alcohol injection or operation for trigeminal neuralgia? W. ALEXANDER. Therap. d. Gegenw., 1925, lxvi, 115.

The treatment of trigeminal neuralgia by alcohol injections into the gasserian ganglion. B. GUTNIKOFF. Arch. f. klin. Chir., 1925, cxxxv, 79.

The report of a case of retrogasserian neurotomy. V. COMBIER and J. MURARD. Bull. et mém. Soc. nat. de chir., 1925, li, 327.

Bilateral recurrent nerve paralysis due to aortic aneurism; report of a case with histological sections of the recurrent nerves. P. B. MACCREADY. Arch. Otolaryngol., 1925, ii, 122. **[440]**

Spinal Cord and Its Coverings

Medullary neuromata. L. MARCHAND. Bull. et mém. Soc. anat. de Par., 1925, xcv, 61.

The principle of myelography. H. PEIPER and H. KLOSE. Arch. f. klin. Chir., 1925, cxxxiv, 303.

A contribution on the surgery of the spinal cord. B., STICH. Arch. f. Psychiat., 1925, lxxiii, 519.

Peripheral Nerves

Principles of the restoration of nerve conduction and its significance with reference to operations on the peripheral nerves. P. ERLACHER. Arch. f. orthop. u. Unfall-Chir., 1925, xxiii, 380.

Nerve freezing in amputation, amputation neuromata, angiospasm, erythromelalgia, senile gangrene and varicose ulcer of the leg. A. LAEWEN. Beitr. z. klin. Chir., 1925, cxxxiii, 405. **[441]**

The surgical treatment of chronic sciatica. W. J. TAYLOR. Atlantic M. J., 1925, xxviii, 756.

Sympathetic Nerves

Angina pectoris. J. B. HERRICK. Northwest Med., 1925 xxiv, 360.

Surgical operations on the sympathetic nerves in cases of spastic paralysis. AIEVOLI. Riforma med., 1925, xli, 464.

Periarterial sympathectomy; technical details. L. DESGOUTTES and A. RICARD. Presse méd., Par., 1925, xxxiii, 734.

Periarterial sympathectomy, a clinical case. E. STINCER. Rev. de med. y cirug. de la Habana, 1925, xxx, 269.

The course of the vascular nerves in the extremities and their action in periarterial sympathectomy. O. WIEDHOPF. Muenchen. med. Wchnschr., 1925, lxxii, 413.

Periarterial sympathectomy in delayed consolidation of fractures. S. RUBASCHOW. Zentralbl. f. Chir., 1925, lii, 635.

Exclusion of the sympathetic by chemical methods (phenol). K. DOPPLER. Med. Klin., 1925, xxi, 547.

The effect of division of the sympathetic nerve upon local infections. E. LIEK. Arch. f. klin. Chir., 1925, cxxxv, 393.

Calorimetric studies of the extremities following lumbar sympathetic ramisection and ganglionectomy. G. E. BROWN and A. W. ADSON. Am. J. M. Sc., 1925, clxx, 232. **[441]**

Miscellaneous

The psychological aspect of railroad injury. B. R. TUCKER and R. F. GAYLE. South. M. J., 1925, xviii, 581.

The importance of correct principles and concerted action in dealing with litigious traumatic neurosis illustrated by a notorious case. T. A. WILLIAMS. South. M. J., 1925, xviii, 584.

The cerebrospinal fluid and blood sugar. E. VOGT. Klin. Wchnschr., 1925, iv, 597.

Vital and supravital studies of the cells of the cerebrospinal fluid and of the meninges in cats. L. S. KUBIE and G. M. SCHULTZ. Bull. Johns Hopkins Hosp., Balt., 1925, xxxvii, 91.

The relation of the calcium content of the spinal fluid to postlumbar puncture headache. M. NEUSTAEDTER, W. W. HALA, and A. TOLSTOOUCHOW. J. Am. M. Ass., 1925, lxxxv, 347.

Clinical and pathologico-anatomical observations on the causes of death after procedures to lessen the intracranial pressure. H. FISCHER. Arch. f. klin. Chir., 1925, cxxxiv, 572.

Why is it that lumbar puncture does not give the brilliant results which are to be expected from the theoretical standpoint? P. BABITZKY. Zentralbl. f. Chir., 1925, lii, 963.

The biological action of vuzin used intraspinally as a therapeutic measure for meningitis. BIRKHOLZ. Arch. f. Ohren-, Nasen- u. Kehlkopfh., 1925, cxii, 261.

SURGERY OF THE CHEST

Chest Wall and Breast

Lactation without pregnancy. R. H. KAHN. Arch. f. d. ges. Physiol., 1925, ccvii, 429.

The physiological symptoms of involution in the female breast after pregnancy and menstruation. M. ERNST. Frankfurt. Ztschr. f. Path., 1925, xxxi, 500.

False tumors of the mammary gland. A. SCHWARTZ. Bull. et mém. Soc. nat. de chir., 1925, li, 618.

Benign tumors of the mammary gland of the male. A. ZENO and F. RUIZ. Bol. y trab. Soc. de cirug. de Buenos Aires, 1925, ix, 144.

The present status of irradiation of cancer of the breast. HOLFELDER. Med. Klin., 1925, xxi, 213, 255. **[443]**

The after-results of operations for malignant disease of the breast. A. C. PERRY. Brit. J. Surg., 1925, xiii, 39. **[443]**

Osteoplastic skeletal metastases from carcinoma of the breast; report of an unusual case. S. GINSBURG. Arch. Surg., 1925, xi, 219.

Trachea, Lungs, and Pleura

Hernia of the lung. J. G. MONTGOMERY and H. LUTZ. Ann. Surg., 1925, lxxxii, 220.

A discussion of the neuropathic origin of pulmonary œdema. E. SCHNEIDER. Muenchen. med. Wchnschr., 1925, lxxii, 424.

Unusual endoscopic experiences. C. P. SCHENCK. Texas State J. M., 1925, xxi, 227.

Roentgen examination of the lungs after the injection of lipiodol into the bronchi. S. KEIJSER. Acta radiol., 1925, iv, 58.

Bacterial constants of the upper respiratory tract. S. J. PEARLMAN. Laryngoscope, 1925, xxxv, 602.

Phrenicotomy in tuberculosis of the lungs. SACHS. Beitr. z. Klin. d. Tuberk., 1925, lxi, 241.

The use of pneumothorax in the treatment of acute tuberculous pneumonia. R. J. GROOM. Colorado Med., 1925, xxii, 264.

Pneumothorax therapy in tuberculosis. C. H. COCKE. N. Orleans M. & S. J., 1925, lxxviii, 76.

Extrapleural thoracoplasty. S. D. GLEETEN. California & West. Med., 1925, xxiii, 1011. **[443]**

The technique of extrapleural thoracoplasty. H. M. DAVIES. Brit. J. Surg., 1925, xiii, 58. **[444]**

Anæsthesia in extrapleural thoracoplasty. BONNIOT. Lyon chir., 1925, xxii, 207.

Thoracoplasty for pulmonary tuberculosis. BÉRARD. Lyon chir., 1925, xxii, 274.

Adrenalin by the endotracheal route in the treatment of hæmoptysis. F. GIUFFRIDA. Riforma med., 1925, xli, 420.

Lung abscess cured by bronchoscopy. M. C. MYERSON. Arch. Otolaryngol., 1925, ii, 136.

A bronchial flexible aspiratory. W. F. MOORE. Laryngoscope, 1925, xxxv, 623.

A bronchoscopic specimen collector. R. M. LUKENS. Laryngoscope, 1925, xxxv, 717.

The rôle of surgery in the treatment of pulmonary suppuration. E. A. GRAHAM. J. Am. M. Ass., 1925, lxxxv, 181. **[444]**

Cysts of the bronchus. G. SULTAN. Zentralbl. f. Chir., 1925, lii, 869.

Localized bronchiectasis. F. C. ARRILLAGA and R. A. IZZO. Rev. Soc. de med. interna, 1925, vi, 5.

X-ray films illustrating lung-mapping with lipiodol in a case of bronchiectasis. W. HOWARTH. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Laryngol., 57.

The value of lipiodol in the diagnosis of bronchiectasis. L. S. T. BURRELL and S. MELVILLE. Lancet, 1925, ccix, 278.

Atelectasis of the lung. H. A. FARRIS. Canadian M. Ass. J., 1925, xv, 808.

The treatment of emphysema of the lung by exeresis of the phrenic nerve. DUENNER and MECKLENBURG. Therap. d. Gegenw., 1925, lxvi, 12.

The treatment of lung and mediastinal neoplasms by high-voltage roentgen therapy. S. STERN. Am. J. Roentgenol., 1925, xiv, 8. **[445]**

Primary pigmented tumors of the lung. W. W. WAITE. Texas State J. M., 1925, xxi, 253.

Malignancy of the lung from the clinical standpoint. C. L. HARRELL. Virginia M. Month., 1925, lii, 304.

Artificial pneumothorax in medicine. M. C. HOWARD. Nebraska State M. J., 1925, x, 302.

Pleural empyema. F. J. O'DONNELL. Med. Press, 1925, n.s. cxx, 147.

Heart and Pericardium

A bullet perforating a ventricle of the heart and migrating by way of the arterial circulation to the superficial femoral artery. J. H. JOPSON. Ann. Surg., 1925, lxxxii, 301.

Calcified pericardium occurring in a patient with peptic ulcer. C. W. RAINEY. Med. J. & Rec., 1925, cxxii, 212.

Resection of the pericardium for concretion. GULEKE and LOMMEL. Klin. Wchnschr., 1925, iv, 737.

Œsophagus and Mediastinum

A case of congenital absence of the œsophagus. E. B. KNERR. Radiology, 1925, v, 165.

The importance of the early diagnosis of œsophagea lesions. J. M. WAUGH. Wisconsin M. J., 1925, xxiv, 115.

Epigastric pain a symptom of œsophageal obstruction. P. P. VINSON. Ann. Surg., 1925, lxxxii, 212.

A vegetative epithelioma of the thoracic portion of the œsophagus with dysphagia; concomitant ectasia of the ascending aorta; death from perforation of the wall of the aorta. J. MOUSSOIR. Bull. et mém. Soc. anat. de Par., 1925, xcv, 96.

The thymus in infancy, especially in the newly born (preliminary report). W. A. MULHERIN, L. P. HOLMES, and H. P. HARRELL. South. M. J., 1925, xviii, 494. [445]

The symptoms and differential diagnosis of thymus hyperplasia in infancy. S. R. KALISKI. Texas State J. M., 1925, xxi, 258.

SURGERY OF THE ABDOMEN

Abdominal Wall and Peritoneum

Hernia in a woman 104 years old. G. W. COTTIS. J. Am. M. Ass., 1925, lxxxv, 356.

Three cases of incarcerated inguinal hernia. A. ZIMMERMANN. Zentralbl. f. Chir., 1925, lii, 410.

An operative procedure for the repair of herniæ complicating permanent colostomies. F. L. BARNES. Texas State J. M., 1925, xxi, 240.

The treatment of eventration secondary to section of the right half of the right rectus. DANIEL. Paris chir., 1925, xvii, 189.

Two tumors of the inguinal ligament. O. MAGATON. Ann. ital. di chir., 1925, iv, 495.

The question of acute serous peritonitis. G. GUREWITSCH. Zentralbl. f. Chir., 1925, lii, 744.

The critical examination of acute serous peritonitis. C. PRIMA. Zentralbl. f. Chir., 1925, lii, 526.

The treatment of peritonitis with intra-abdominal injections of hypertonic glucose solution. J. K. NARAT. Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1925, xxxviii, 429.

Internal incarceration of the intestines in mesenteric clefts. I. M. TALMANN. Arch. f. klin. Chir., 1925, cxxv, 776. [446]

A case of chyle cysts with serous cysts of the mesentery. S. SOFOTEROFF. Zentralbl. f. Chir., 1925, lii, 747.

Torsion of the great omentum. J. SARNOFF. Ann. Surg., 1925, lxxxii, 312.

Serous cyst of the great omentum. G. BERNADET. Gynéc. et obst., 1925, xi, 374.

Gastro-Intestinal Tract

The anatomy and physiology of the gastro-intestinal tract from the roentgenological standpoint. J. CUNHA. An. Fac. de med., Univ. de Montevideo, 1925, x, 409.

Gastrocolohepatoptosis, cæcal and gastric ectasia; chronic appendicitis; its surgical treatment and the results obtained in cases operated upon. F. E. CIARLO. Semana méd., 1925, xxxii, 1148.

Some intramural causes of cramps of the alimentary canal. A. JIRÁSEK. Acta chirurg. Scand., 1925, lix, 91.

History taking of chronic gastro-intestinal disease. W. GOLDIE. J. Iowa State M. Soc., 1925, xv, 346. [446]

A new case of double cancer of the digestive tube. BARIÉTY and HUGUENIN. Bull. et mém. Soc. anat. de Par., 1925, xcv, 31.

A brooch extracted by gastrotomy in the case of a child of 6 months. LAURENCE. Paris chir., 1925, xvii, 178.

The muscular mechanism of the stomach. S. K. SIMON and E. C. SAMUEL. N. Orleans M. & S. J., 1925, lxxviii, 93.

Gastrotonometry. C. CARONES. Rev. méd. d. Rosario, 1925, xv, 124.

Visceroptosis of the stomach and colon and its treatment by mechanotherapeutics. E. F. CYRIAX. Med. Press, 1925, n.s. cxx, 150.

The growth of the crypts and glands of the human stomach. G. H. SCOTT. Am. J. Dis. Child., 1925, xxx, 147.

The action of vagotrophic and sympatheticotrophic substances on gastric digestion. E. H. BARRÓN. Crón. méd., Lima, 1925, xlii, 136.

Bacterial vaccines by the gastric and rectal route. A. PÉREZ MIRÓ. Rev. de med. y cirug. de la Habana, 1925, xxx, 281.

Pyloric obstruction in infants with a nervous heredity. R. L. PITFIELD. Med. J. & Rec., 1925, cxxii, 148.

Congenital hypertrophic pyloric stenosis: a review of 454 cases in which the Fredet-Rammstedt operation was performed. R. W. BOLLING. J. Am. M. Ass., 1925, lxxxv, 20. [447]

Pyloric stenosis of infants: a statistical analysis of sixty cases. W. C. DAVISON. Bull. Johns Hopkins Hosp., Balt., 1925, xxxvii, 75. [447]

The importance of X-ray examination in pylorospasm of infants and for the estimation of the length of time necessary for a cure. HULE. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

Diverticulum of the stomach, accidental finding in routine examination. I. GRAY. Am. J. Roentgenol., 1925, xiv, 110.

Acute dilatation of the stomach and tetanoid convulsions following operation for hernia. J. H. JOPSON. Ann. Surg., 1925, lxxxii, 303.

Some difficulties in the diagnosis of diseases of the stomach, with special reference to extragastric causes. L. C. WILLIAMS. J. Oklahoma State M. Ass., 1925, xviii, 184.

A contribution on the pathology of the stomach. IV. The clinical aspects. V. ORATOR. Arch. f. klin. Chir., 1925, cxxxiv, 663.

Further studies of the ulcer question with a demonstration of experimentally produced ulcers. G. KELLING. Arch. f. klin. Chir., 1924, cxxxii, 95.

Experimental gastric and duodenal inflammation and ulcer. A. HOFFMANN. Am. J. M. Sc., 1925, clxx, 212.

Ulcer of the stomach in a child of 8 years. CEBALLOS. Bol. y trab. Soc. de cirug. de Buenos Aires, 1925, ix, 137.

A case of peptic ulcer. LAGOUTTE. Lyon chir., 1925, xxii, 254.

Hour-glass stomach—case report. D. W. PALMER. Cincinnati J. M., 1925, vi, 304.

Perforation of gastric ulcer. K. GUTH. Med. Klin., 1925, xxi, 546.

Acute perforated gastric and duodenal ulcers. S. E. KERNODLE. J. Oklahoma State M. Ass., 1925, xviii, 180.

Simple penetrating ulcer of the greater curvature of the stomach. E. S. BLAINE. Am. J. Roentgenol., 1925, xiv, 20. [447]

The diagnosis and medical treatment of gastric and duodenal ulcer. W. H. RENDLEMAN. J. Iowa State M. Soc., 1925, xv, 363. [447]

The non-surgical management of peptic ulcer by the physiological rest method; a report of the results of treatment in 470 patients. F. SMITHIES. J. Am. M. Ass., 1925, lxxxv, 674.

Experimental studies of biological methods of treating gastric and duodenal ulcer. NAUMANN. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

The etiology and surgical treatment of ulcer of the stomach and duodenum. C. E. DAKIN. J. Iowa State M. Soc., 1925, xv, 367. [449]

Emergency gastrotomy for severe hæmatemesis. P. de LOSTALOT. Paris chir., 1925, xvii, 186.

The choice of operation in peptic ulcer. L. D. MCGUIRE. Nebraska State M. J., 1925, x, 297.

Experiences in the surgical treatment of gastric and duodenal ulcers. J. PETERMANN. Arch. f. klin. Chir., 1925, cxxxv, 495.

The surgical treatment of ulcers of the stomach and duodenum and their complications. L. CARVALHAL. Arch. brasil. de med., 1925, xv, 208.

The question of gastro-enterostomy. V. C. IRK. Zentralbl. f. Chir., 1925, lii, 1021.

Gastro-entero-anastomosis with prophylactic vagotomy. PODKAMINSKY. Zentralbl. f. Chir., 1925, lii, 568.

The study of gastro-intestinal mucosa after gastro-enterostomy. H. HELLMER. Acta radiol., 1925, iv, 32. [449]

The management of lesions of the stomach and duodenum. D. C. BALFOUR. Surg. Clin. N. Am., 1925, v, 673. [450]

The roentgen diagnosis and symptoms of diffuse polyposis of the stomach. R. SIELMANN and R. SCHINDLER. Fortschr. a. d. Geb. d. Roentgenstrahlen, 1925, xxxiii, 191.

A review of carcinoma of the stomach. P. R. FARRINGTON. Colorado Med., 1925, xxii, 271.

The significance of carcinoma of the stomach with reference to the indication for operation in the management of gastric ulcer. H. FINSTERER. Wien. klin. Wchnschr., 1925, xxxviii, 295, 321.

The question of ulcer carcinoma of the stomach. O. STOERK. Wien. klin. Wchnschr., 1925, xxxviii, 347.

Ulcer and carcinoma of the stomach. V. ORATOR. Wien. klin. Wchnschr., 1925, xxxviii, 425.

The question of ulcer carcinoma from the roentgen standpoint. G. SCHWARZ. Wien. klin. Wchnschr., 1925, xxxviii, 478.

The two-stage operation in cancer of the pylorus. J. L. RANSOHOFF. Ohio State M. J., 1925, xxi, 562.

Diet after gastric operations. A. JAROTZKY. Zentralbl. f. Chir., 1925, lii, 791.

Experimental gastro-œsophageal surgery. SUERMONDT. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

Statistics of gastric operations from the municipal hospital of Chemnitz from 1907 to 1922, with particular reference to late results. E. BIRGFELD. Arch. f. klin. Chir., 1925, cxxxiv, 51.

A case of mechanical ileus. F. R. RUIZ. Rev. Soc. argent. de biologia, 1925, i, 192.

Two attacks of gall-stone ileus. K. HILLE. Muenchen. med. Wchnschr., 1925, lxxii, 597.

A case of hernia incarcerated in the foramen of Winslow. A. WESTMAN. Acta chirurg. Scand., 1925, lix, 181. [450]

A mesenteric sarcoma of the intestine and of Meckel's diverticulum. G. BAKÁCS. Frankfort. Ztschr. f. Path., 1925, xxxi, 89.

Enterostomy as a relief operation. N. N. NASAROFF. Deutsche Ztschr. f. Chir., 1925, cxc, 113.

Late results after extensive resection of the small intestine. FRANGENHEIM. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

A fistula secondary to a wound of the duodenum. L. H. PETIT. Bull. et mém. Soc. nat. de chir., 1925, li, 598.

A needle perforating the duodenum. R. B. BETTMAN and A. R. BLOOM. Radiology, 1925, v, 161.

The diagnostic value of the duodenal sound. H. G. MOGENA. Prog. de la clin., Madrid, 1925, xxxi, 608.

A study of duodenal ulcer with special reference to the symptomatology and diagnosis. F. L. SNYDER. J. Michigan State M. Soc., 1925, xxiv, 419.

The roentgen diagnosis of duodenal ulcer. S. C. VENABLE. J. Oklahoma State M. Ass., 1925, xviii, 190.

The value of gastro-enterostomy in the treatment of duodenal ulcer. J. A. HARTWELL and G. S. DUDLEY. J. Iowa State M. Soc., 1925, xv, 337. [450]

Anatomosurgical considerations on the technique of duodenojejunostomy. R. E. DÓNOVAN. Rev. méd. Lat.-Am., 1925, x, 897.

Cure of intestinal fistula near the duodenojejunal junction. H. KOSTER. Ann. Surg., 1925, lxxxii, 310.

Primary carcinoma of the duodenum. G. B. EUSTERMAN, D. M. BERKMAN, and T. G. SWAN. Ann. Surg., 1925, lxxxii, 153. [451]

Diverticula of the jejunum. J. MOREAU. Arch. franco-belges de chir., 1925, xxviii, 192.

Diverticula of the jejunum. N. S. ROTHSCHILD. Ann. Surg., 1925, lxxxii, 250. [451]

Postoperative peptic ulcers. DELORE. Lyon chir., 1925, xxii, 260.

Cases of postoperative peptic ulcer of the jejunum in children, and a contribution on the subject of ulcer in childhood. E. MICHAËLSSON. Acta chirurg. Scand., 1925, lix, 139. [452]

Two cases of peptic ulcer with colic fistula. LAGOUTTE. Lyon chir., 1925, xxii, 240.

Recurring peptic ulcer of the jejunum. A. ZENO. Bol. y trab. Soc. de cirug. de Buenos Aires, 1925, ix, 153.

Pernicious anæmia following ileostomy. C. F. DIXON, J. G. BURNS, and H. Z. GIFFIN. J. Am. M. Ass., 1925, lxxxv, 17. [452]

A clinical study of colonic function. E. L. GARDNER. Minnesota Med., 1925, viii, 498.

The sigmoidoscopic picture of chronic ulcerative colitis (non-specific). B. B. CROHN and H. ROSENBERG. Am. J. M. Sc., 1925, clxx, 220.

Intestinal obstruction. M. F. PORTER. J. Indiana State M. Ass., 1925, xviii, 283.

Intestinal obstruction due to Lane's ileal membrane. GINESTY. Bull. et mém. Soc. nat. de chir., 1925, li, 598.

Experimental high intestinal obstruction: relief by irrigation and control of alkalosis—preliminary report. M. M. PORTIS and B. PORTIS. J. Am. M. Ass., 1925, lxxxv, 574.

Acute intestinal obstruction complicating chronic pulmonary tuberculosis—case report. A. L. ALDRICH. U. S. Naval M. Bull., 1925, xxiii, 137.

A case of acute intestinal obstruction due to the presence of a drainage tube left in the peritoneal cavity. R. L. WILLIAMS. Lancet, 1925, ccix, 219.

Spastic intestinal obstruction with intraperitoneal hæmorrhages. H. REIMER. Arch. f. klin. Chir., 1925, cxxxv, 520.

Torsion of a hæmatosalpinx adherent to the intestine; acute obstruction. R. MONOD. Bull. et mém. Soc. anat. de Par., 1925, xcv, 38.

Enteroliths and diverticula, especially enteroliths contained in diverticula of the large bowel; report of a case. M. F. PORTER. Surg., Gynec. & Obst., 1925, xli, 185.

Colon resection in chronic obstipation. FINSTERER. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

Strangulation of the intestine in prolapse of an artificial anus. BONNET and RICARD. Lyon chir., 1925, xxii, 284.

Stenosis of the intestine secondary to hernial strangulation. LEURET. Paris chir., 1925, xvii, 173.

The pathogenicity of trichomonas intestinalis. H. TSUCHIYA. Arch. Int. Med., 1925, xxxvi, 174.

Tenia saginata in the intestine of man. MOSTO and D. PABLO BOSQ. Semana méd., 1925, xxxii, 1057.

The relation between antiperistalsis and Bauhin's valve and their importance in spastic diseases of the intestines. HEILE. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

Intestinal paralysis in peritonitis. W. BUDDE. Arch. f. klin. Chir., 1925, cxxxiv, 486.

The diagnosis and surgical treatment of diverticulitis of the large bowel. F. de QUERVAIN. Arch. franco-belges de chir., 1925, xxviii, 185.

The etiology and treatment of Hirschsprung's disease, particularly with reference to intestinal obstruction resulting therefrom. BRUENING. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

Volvulus of a pelvic megacolon. PAITRE. Lyon chir., 1925, xxii, 244.

Papillomata of the large bowel. V. C. DAVID. Ann. Surg., 1925, lxxxii, 109. **[452]**

Appendicitis. H. L. BROCKMANN. South. M. & S., 1925, lxxxvii, 485.

Physical factors in the production of appendicitis; points in the diagnosis; their influence on surgical treatment. SIR H. GRAY. Illinois M. J., 1925, xlviii, 33. **[453]**

Appendicitis and appendiceal abscesses in middle China. E. BIRT. Zentralbl. f. Chir., 1925, lii, 683.

Appendicitis and transposition of the viscera. B. C. WILLIS. Ann. Surg., 1925, lxxxii, 256.

Acute appendicitis occurring in the course of tuberculous peritonitis. A. CORVESE. Rhode Island M. J., 1925, viii, 125.

Technical aspects of acute appendicitis. G. MULLER. Atlantic M. J., 1925, xxviii, 749. **[453]**

When should one intervene in acute appendicitis? M. CASTAÑEDA. Crón. méd., Lima, 1925, xlii, 97.

Appendicitis and oxyuria. H. STEICHELE. Arch. f. klin. Chir., 1925, cxxxv, 373.

An inflammatory tumor of the abdomen and calculous appendicitis. R. STINCER. Rev. de med. y cirug. de la Habana, 1925, xxx, 285.

"Chronic appendicitis or what?" F. N. G. STARR. Med. J. Australia, 1925, ii, 63.

Chronic appendicitis: bases for varied clinical manifestations. M. I. BIERMAN. Radiology, 1925, v, 152.

Ligation and drop treatment of the appendectomy stump. J. J. MALONEY. Ann. Surg., 1925, lxxxii, 260.

Postappendectomy pylephlebitis with liver abscess. E. L. ELIASON. Ann. Surg., 1925, lxxxii, 308.

Argentaffine tumors of the appendix and small intestine. W. D. FORBUS. Bull. Johns Hopkins Hosp., Balt., 1925, xxxvii, 130. **[454]**

Endometrioid adenomyoma and endometrioid adenomatosis of the appendix. S. SUZUKI. Arch. f. path. Anat., 1924, ccl, 579.

Persistent fæcal fistula treated by ileocæcal resection and ileocolostomy. J. H. JOPSON. Ann. Surg., 1925, lxxxii, 306.

Colectomy for obstruction secondary to cæcosigmoidostomy. DUNET. Lyon chir., 1925, xxii, 278.

Three cases of megasigmoid, one with volvulus; three cures following the Mikulicz operation. J. HERTZ. Bull. et mém. Soc. nat. de chir., 1925, li, 494. **[454]**

Volvulus of a sigmoid megacolon. BONNIOT. Lyon chir., 1925, xxii, 204.

Megasigmoid; acute obstruction from volvulus and valvular occlusion. R. FINOCHIETTO. Semana méd., 1925, xxxii, 1033.

Colectomy for sigmoid megacolon. LECÈNE and ROUX-BERGER. Paris chir., 1925, xvii, 190.

Carcinoma of the sigmoid colon. W. C. MENNINGER and H. G. HOLDER. Med. J. & Rec., 1925, cxxii, 126.

The surgery of cancer of the rectum. KIRSCHNER. Arch. f. klin. Chir., 1924, cxxxiii, 156.

Abdominotransanal amputation of the rectum. VILLARD. Lyon chir., 1925, xxii, 236.

The nature of anal fistula. C. PIOLA. Rev. méd. d. Rosario, 1925, xv, 107.

Tuberculosis of the anus and rectum. C. J. DRUECK. Chicago M. Rec., 1925, xlvii, 263.

The relationship of tuberculosis to fistula *in ano*. W. A. FANSLER. J. Am. M. Ass., 1925, lxxxv, 671.

Liver, Gall Bladder, Pancreas, and Spleen

The present status of the physiology and pathology of the liver. F. FISCHLER. Berlin: Springer, 1925.

The anatomy of the so-called accessory liver. P. WALZEL and E. GOLD. Arch. f. klin. Chir., 1925, cxxxv, 138.

Pathological changes in the wall of the liver. F. METZLER. Arch. f. klin Chir., 1925, cxxxiv, 794.

Hydatid cysts of the liver opening into the biliary passages. D. PRAT and C. PIQUEREZ. An. Fac. de med., Univ. de Montevideo, 1925, x, 204.

Hydatid cysts of the liver opening into the bile passages. H. G. LAGOS. An. Fac. de med., Univ. de Montevideo, 1925, x, 395.

A hydatid cyst of the liver passing into the bile passages. R. RODRIGUEZ VILLEGAS. Semana méd., 1925, xxxii, 995.

Suppurating cysts of the liver; operation under local anæsthesia; another large cyst and purulent cysts opening spontaneously into the thorax causing pleural inundation and rapid death. VERGOZ and CORTEZ. Bull. et mém. Soc. anat. de Par., 1925, xcv, 69.

Primary liver abscess with congenital absence of the gall bladder and diabetes. F. C. WARNSHUIS. J. Michigan State M. Soc., 1925, xxiv, 423.

Abscess of the liver treated by Roger's method. M. IRIART. Rev. Soc. de med. interna, 1925, vi, 20.

Hepatic syphilis. O. A. QUIJANO. Rev. méd. Lat.-Am., 1925, x, 904.

Bile pigment metabolism in biliary tract disease. G. P. MULLER, I. S. RAVDIN, and E. G. RAVDIN. J. Am. M. Ass., 1925, lxxxv, 86. **[454]**

Experimental studies on chromocholoscopy. W. SUCHOW. Arch. f. klin. Chir., 1925, cxxxv, 356.

Jaundice. J. B. DEAVER. Surg., Gynec. & Obst., 1925, xli, 166.

The clinical value of the Van den Bergh reaction for bilirubin in the blood; with notes on improvements in its technique. J. W. MCNEE and C. S. KEEFER. Brit. M. J., 1925, ii, 52. **[454]**

The Van den Bergh test for icterus in the blood of infants. C. G. GRULEE and A. MEBANE. Am. J. Dis. Child., 1925, xxx, 219.

A note on the Van den Bergh reaction after deep roentgen irradiation. G. CAMERON and H. FLECKER. Am. J. Roentgenol., 1925, xiv, 133.

The function of the sphincter of the choledochus in proceedings for stimulating the secretion of bile. O. SPECHT. Beitr. z. klin. Chir., 1925, cxxxiii, 213.

Graham's test in the roentgen diagnosis of affections of the bile passages. J. A. SARALEGUI, E. L. VILA, and P. MAHIEU. Rev. Soc. de med. interna, 1925, vi, 39.

The relationship between diseases of the biliary tract and diabetes mellitus. I. A. BIGGER and H. B. MULHOLLAND. Virginia M. Month., 1925, lii, 294.

Diathermy in biliary affections. D. KOBAK. Clin. Med., 1925, xxxii, 521.

Drainage in infection of the liver, bile ducts and gall bladder. A. S. LOBINGIER. J. Am. M. Ass., 1925, lxxxv, 85. **[455]**

Experimental studies in bile disinfection. SPECHT. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

A case of stone in the biliary tract with cystic dilatation and a diverticulum of the common bile duct. G. SOEDERLUND. Acta chirurg. Scand., 1925, lix, 253. **[455]**

Occlusion of the biliary passages by cholesterol sand. K. BUEDINGER. Arch. f. klin. Chir., 1925, cxxxv, 406. **[455]**

Choledochotomy for lithiasis. A. GOSSET. Presse méd. Par., 1925, xxxiii, 497. **[455]**

Surgery of the gall tracts. R. C. COFFEY. Northwest Med., 1925, xxiv, 326, 378. **[456]**

Some debatable points in the surgery of the gall tract. W. D. HAGGARD. Surg., Gynec. & Obst., 1925, xli, 92. **[457]**

The physiology of the gall bladder. M. CHIRAY and I. PAVEL. Presse méd., Par., 1925, xxxiii, 713.

Reflex reactions of the gall bladder on the digestive tract. F. RAMOND and G. PARTURIER. Presse méd., Par., 1925, xxxiii, 625.

Axial rotation of the gall bladder. A. SUTTER. Beitr. z. klin. Chir., 1925, cxxxiii, 519.

The diagnosis and treatment of gall-bladder disease—medical aspects. J. PHILLIPS. Illinois M. J., 1925, xlviii, 123.

The roentgenological diagnosis of disease of the gall bladder. R. D. CARMAN. Radiology, 1925, v, 101.

A clinical roentgenological study of the gall bladder. J. C. FRIEDMAN, A. A. STRAUSS and R. A. ARENS. Radiology, 1925, v, 93.

Tetrabromphenolphthalein injection as an office procedure. C. D. ENFIELD. Radiology, 1925, v, 104.

Recent advancements in cholecystography. W. H. STEWART, M. EINHORN, and E. J. RYAN. N. York State J. M., 1925, xxv, 825. **[457]**

Cholecystography by the oral administration of soluble radiopaque salts. C. S. OAKMAN. Am. J. Roentgenol., 1925, xiv, 105.

Gangrenous cholecystitis. M. RENAUD. Bull. et mém. Soc. anat. de Par., 1925, xcv, 123.

Causes of death in cholecystitis. W. A. BRYAN. South. M. J., 1925, xviii, 524. **[458]**

The gastric syndrome of cholelithiasis. F. FEDELI. Riforma med., 1925, xli, 415.

Follow-up findings in patients operated upon for gall stones in the Goettingen Clinic in the period from 1912 to 1920. P. SEULBERGER. Deutsche Ztschr. f. Chir., 1925, cxc, 1. **[458]**

Cholecystectomy. G. W. MILLETT. Northwest Med., 1925, xxiv, 383.

Cholecystectomy in gall-bladder disease. L. W. ELSTON. J. Indiana State M. Ass., 1925, xviii, 286.

One hundred consecutive cholecystectomies. W. O. JOHNSON. Am. J. M. Sc., 1925, clxx, 181.

Surgical treatment of diseases of the gall bladder. F. E. BUNTS. Ann. Surg., 1925, lxxxii, 232. **[458]**

Acute necrosis of the pancreas and abdominal steatonecrosis of traumatic origin. C. ARRIGONI and A. FUCCI. Riforma med., 1925, xli, 489.

Acute hæmorrhagic pancreatitis complicated by nephritis. J. N. FOGARTY and I. M. HAY. South. M. J., 1925, xviii, 617.

The treatment of fistula of the pancreas and of the pancreatic duct. O. KLEINSCHMIDT. Arch. f. klin. Chir., 1925, cxxxv, 363.

Sarcoma of the pancreas. H. MARXER. Arch. f. klin. Chir., 1925, cxxxv, 606.

Surgery of the pancreas. N. GULEKE. Verhandl. f. Verdauungs- u. Stoffwechsel-krankh., 1925, 113.

Wandering spleen with torsion of its pedicle. J. E. SUTTON, JR. Ann. Surg., 1925, lxxxii, 239.

Traumatic rupture of the spleen, splenectomy. L. W. FRANK. Kentucky M. J., 1925, xxiv, 431.

Spontaneous rupture of the spleen. M. G. WOHL. Ann. Surg., 1925, lxxxii, 246.

Two cases of tuberculous splenomegaly. E. R. CARLING and J. A. B. HICKS. Brit. M. J., 1925, ii, 291.

Splenomegaly of the Gaucher type. KRITCH, PACHINE and ISCHOUMADOW. Bull. et mém. Soc. anat. de Par., 1925, xcv, 24.

The indications and results of splenectomy in children suffering from congenital hæmolytic icterus. C. LEMAIRE. Presse méd., Par., 1925, xxxiii, 704.

Splenectomy in thrombopenic purpura hæmorrhagica. B. VINCENT. Boston M. & S. J., 1925, cxciii, 191. **[459]**

Vaccine treatment of splenomegaly in chronic malaria. R. E. I. JOHNSON. Brit. M. J., 1925, ii, 293.

The removal of a large spleen from a patient with malaria who had had fever for several years. D. GIORDANO. Riforma med., 1925, xli, 296. **[459]**

Miscellaneous

Transposition of the viscera. E. RUIZ VISO and O. VAN STENIS. Rev. de med. y cirug. de Caracas, 1925, viii, 127.

The uses of cœlioscopy. A. R. SHORT. Brit. M. J., 1925, ii, 254.

Acute abdominal emergencies. W. W. REED. Colorado Med., 1925, xxii, 281.

Differential abdominal diagnosis. A. L. BLESH. Texas State J. M., 1925, xxi, 236.

The function of the smooth muscle and its influence on the development of pain. F. SIEGERT. Arch. f. Gynaek., 1925, cxxiii, 774.

A study of the family histories of 300 patients suffering from chronic upper abdominal lesions. G. P. B. HUDDY. Lancet, 1925, ccix, 276.

Significance of pain in right lower abdomen. L. J. STARRY. J. Oklahoma State M. Ass., 1925, xviii, 187.

Note on the treatment of abdominal sepsis. J. O'CONOR. Ann. Surg., 1925, lxxxii, 314.

Intraperitoneal treatment with rivanol. E. PERITZ. Med. Klin., 1925, xxi, 664.

A systematized technique for treating abdominal fistulæ. C. C. MILLER. Med. Times, 1925, liii, 183.

Retroperitoneal lymph cysts. C. BARTHELS. Beitr. z. klin. Chir., 1925, cxxxiii, 397. **[460]**

A massive retroperitoneal lipoma springing from the perirenal fat. E. A. SCHUMANN. Am. J. Obst. & Gynec., 1925, x, 274.

A presacral and retrorectal epithelial tumor. MAUCLAIRE and FLIPO. Bull. et mém. Soc. anat. de Par., 1925, xcv, 52.

A double abdominal catastrophe. N. E. DAVIS. Med. J. Australia, 1925, ii, 137.

The treatment of patients before and after abdominal operations. H. J. PATERSON. Practitioner, 1925, cxv, 128.

The prevention of postoperative abdominal adhesions. C. PRIMA. Zentralbl. f. Chir., 1925, lii, 930.

Diaphragmatic hernia. C. FORD. Radiology, 1925, v, 158.

Observations of true para-œsophageal diaphragmatic hernia and their relation to anomalies of the diaphragm. F. STADTMUELLER. Ztschr. f. d. ges. Anat. U. Entwicklungsgesch., 1925, lxxvi, 188.

Report of an interesting type of diaphragmatic hernia of the cardia of the stomach through the œsophageal orifice. J. FRIEDENWALD and M. FELDMAN. Am. J. M. Sc., 1925, clxx, 263.

Experiences with splanchnic anæsthesia according to Braun's method. TOENNISSEN. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

The use of splanchnic anæsthesia in major abdominal operations. H. FINSTERER. Arch. f. klin. Chir., 1924, cxxxi, 1.

GYNECOLOGY

Uterus

The symptoms and indications for treatment in retroposition of the uterus. M. USANDIZAGA SORALUCE. Arch. de med., cirug. y especial., 1925, xix, 241.

Mechanical support of the uterus; its indications and technique. M. S. SEELY. Texas State J. M., 1925, xxi, 252.

Congenital and evolutionary elongations of the uterine cervix. Séjournet. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 276.

Report of a case of uterus duplex bicornis cum vagina duplici. J. W. PRICE, JR. Am. J. Obst. & Gynec., 1925, x, 269.

A case of double uterus with a partially double vagina. P. WIART and M. SUREAU. Gynéc. et obst., 1925, xi, 101.

The implantation of the obliterated cornu. P. STRASSMANN. Ztschr. f. Geburtsh. u. Gynaek., 1924, lxxxviii, 199, 230.

Double uterus; expulsion of a decidual membrane; absence of pregnancy. CHAMPY, LÉVY-SOLAL, and MÉRAT. Bull. et mém. Soc. anat. de Par., 1925, xcv, 34.

Studies of uterine histophysiology. H. KEIFFER. Gynéc. et obst., 1925, xi, 265.

The recognition of hæmosiderin in the endometrium. W. POESCH. Arch. f. Gynaek., 1925, cxxiii, 671.

Logical handling of non-malignant cervical disease, including congenital deformities, lacerations, and inflammations. M. J. GELPI. Am. J. Obst. & Gynec., 1925, x, 283.

The etiology of fistula of the uterine cervix following abortion. F. A. VONNEGUT. Zentralbl. f. Gynaek., 1925, xlix, 608.

A simple method of cauterization of the cervix. S. F. ABRAMS. J. Am. M. Ass., 1925, lxxxv, 418.

Radium treatment of chronic cervicitis. N. CAPIZZANO. Rev. Soc. Argent. radio y electrol., 1925, i, 16.

The rôle of the cervix in sterility. I. W. KAHN. Am. J. Obst. & Gynec., 1925, x, 254.

Report of a case of hæmatometra. W. C. JONES. N. Orleans M. & S. J., 1925, lxxviii, 95.

Mæmatometra following amputation of the cervix and radiation. W. D. PHILLIPS. Am. J. Obst. & Gynec., 1925, x, 281.

The treatment with radium of uterine hæmorrhage from benign lesions. A. STRAUSS and L. A. POMEROY. Ohio State M. J., 1925, xxi, 493. [461]

Arrest of hæmorrhage of the uterus by grasping the parametrium with a double bladed forceps. M. HENKEL. Ztschr. f. Geburtsh. u. Gynaek., 1925, lxxxviii, 678.

Studies of a salt of beta-pyridon and some nicotine acid derivatives and their effect upon the uterus. R. JOACHIMOVITS. Arch. f. Gynaek., 1925, cxxiii, 769.

Tuberculosis of the body of the uterus. C. DANIEL. Gynéc. et obst., 1925, xi, 161.

Tuberculosis of the portio. N. ELLERBROEK. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxix, 62.

The development of heterotopic uterine mucosa and decidua. J. WIELOCH. Arch. f. Gynaek., 1925, cxxiv, 53.

The development of heterotopic growths of the structure of the uterine mucosa. A. LAUCHE. Zentralbl. f. allg. Path. u. path. Anat., 1925, xxxv, 676.

The anatomy and genesis of endometrial adenomyosis. I. KITAI. Arch. f. Gynaek., 1925, cxxiv, 178.

Rôle of the ovaries in pathogenesis of uterine fibroma. C. DANIEL and A. BABÈS. Gynec. & obst., 1925, iii, 5.

An enormous parasitic fibroma originating in the uterus. E. A. SCHUMANN. Am. J. Obst. & Gynec., 1925, x, 272.

A double myomatous uterus and dermoid cysts of the ovary. J. ADEODATO. Gynéc. et obst., 1925, xi, 369.

Fibroma and radium therapy. TIXIER. Lyon chir., 1925, xxii, 247.

Uterine myoma and deep radiotherapy. H. CAUFMAN. Gynec. si obst., 1925, iii, 8.

Accidents in the radium treatment of fibromata. P. MORNARD. Paris chir., 1925, xvii, 185.

Abdominal myomectomy. DELFOURD. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 329.

Late results of myomectomy. DELFOURD. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 330.

Pregnancy and labor four years after a triple abdominal myomectomy. REEB. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 345.

Cancer of the cervix in a case of complete uterine prolapse. G. JEAN and VILLECHAISE. Bull. et mém. Soc. nat. de chir., 1925, li, 606.

A case of epithelioma of the cervix developing after subtotal hysterectomy. GUYOT, PRINCETEAU, and VILLAR. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 302.

Cancerous infiltration of the true pelvis with symptoms of chronic intestinal obstruction due to a small epithelioma of the body of the uterus. R. HUGUENIN. Bull. et mém. Soc. anat. de Par., 1925, xcv, 133.

A uterine epithelioma developing on a cicatricial lesion. PÉRAIRE. Paris chir., 1925, xvii, 179.

Uterine malformation; chorionepithelioma. MICHEL and LUCIEN. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 326.

The Problem of Cancer of the Uterus. B. P. WATSON. Brit. M. J., 1925, li, 279. [461]

Carcinoma of the cervix. V. BONNEY. Brit. M. J., 1925, ii, 281. [461]

Malignant disease of the ovaries and fallopian tubes. S. J. CAMERON. Brit. M. J., 1925, ii, 285. [461]

The treatment of early carcinoma of the uterus. J. W. SHERRICK. California & West. Med., 1925, xxiii, 1002.

A brief review of the indications and technical procedures employed by the authors in the treatment of cancers of the uterine cervix and body. C. F. BURNAM and W. NEILL, JR. Radiology, 1925, v, 1. [462]

Irradiation in cancer of the cervix. F. J. TAUSSIG. Radiology, 1925, v, 5. [462]

The etiology, pathology, and treatment of cancer of the cervix. D. T. QUIGLEY. Radiology, 1925, v, 9. **[462]**

A preliminary report of primary carcinoma of the cervix uteri treated with radium in the Woman's Hospital in the State of New York. L. K. P. FARRAR. N. York State J. M., 1925, xxv, 855; Am. J. Obst. & Gynec., 1925, x, 205.

Radium treatment of carcinoma of the cervix uteri: results at the Woman's Hospital after five years. G. G. WARD and L. K. P. FARRAR. J. Am. M. Ass., 1925, lxxxv, 159. **[463]**

Radium in the treatment of carcinoma of the cervix. W. P. GLENDON. J. Med. Soc. N. Jersey, 1925, xxii, 279.

Cystoscopy in cancer of the neck of the uterus before and after radium therapy; a study of 200 cases. R. GOUVERNEUR and S. FABRE. Gynéc. et obst., 1925, xi, 189.

Adnexal and Periuterine Conditions

An isolated fibroma of the broad ligament. A. GUILLEMIN. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 330.

Operation for posterior parametritis. J. KREBS. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxix, 130.

Regularity in the changes of ovarian function. A. RUEHL. Arch. f. Gynaek., 1925, cxxiv, 1.

Critical remarks with reference to so-called stimulation radiation of the ovaries. F. C. GELLER. Zentralbl. f. Gynaek., 1925, xlix, 1013.

Experimental studies of the internal secretion of the ovary by means of parabiosis of rats. N. GOTO. Arch. f. Gynaek., 1925, cxxiii, 387.

The ovarian follicular hormone: its distribution in human genital tissues. E. ALLEN, J. P. PRATT, and E. A. DOISY. J. Am. M. Ass., 1925, lxxxv, 399. **[464]**

Studies on the lipoid content of the corpus luteum. A, HERMSTEIN. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxix, 125.

Studies on the relation between bile secretion and the ovaries. Y. TOMINAGA. Biochem. Ztschr., 1925, clvii, 126.

An experimental study of the relation of the ovary to fat metabolism. M. T. BURROWS and C. G. JOHNSTON. J. Exper. Med., 1925, xlii, 215.

Cancer, the ovary, and the placenta. O. O. FELLNER. Muenchen. med. Wchnschr., 1925, lxxii, 676.

Homotransplantation of the ovaries. H. HARTTUNG. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxix, 74.

Ovarian graft: an analysis of fifty cases. G. S. FOSTER. Am. J. Surg., 1925, xxxix, 197.

A study of the nerve fibers in sclerocystic ovaritis. J. LHERMITTE and R. DUPONT. Bull. et mém. Soc. anat. de Par., 1925, xcv, 116.

The relation of cystic changes of the ovaries to vesical mole and chorionepithelioma. H. KUESTNER. Monatsschr. f. Geburtsh. u. Gynaek., 1924, lxvii, 359.

The mechanism of axial torsion of ovarian tumors. L. GOTTLIEB. Dissertation: Frankfort, 1924.

Seminoma of the ovary. R. DUPONT and L. C. SIMARD. Bull. et mém. Soc. anat. de Par., 1925, xcv, 124.

Dermoid cysts containing masses of fat. J. WLADIMIRSKY. Beitr. z. Prob. d. Gynaek. u. d. Carcin., 1925, 167.

A teratoma of the ovary with a free pelvis and extremities. R. MEYER. Arch. f. Gynaek., 1925, cxxiii, 714.

Observations on twenty-nine cases of ovarian cysts. M. C. ALJOVÍN and C. Busch. Crón. méd., Lima, 1925, xlii, 172.

An endometrial ovarian cyst with unusual clinical features. R. GOLDSMITH. Am. J. Obst. & Gynec., 1925, x, 274.

Removal of a 74-lb. cyst under local anæsthesia. E. S. ALLEN. Kentucky M. J., 1925, xxiv, 421.

Clinical signs of pathological rupture of ovarian cysts. PATEL. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 320.

Ruptured ovarian cyst with serum rash. J. P. KENNEDY. J. Am. M. Ass., 1925, lxxxv, 517.

A pure fibroma of the ovary with the symptoms of a malignant tumor. F. PAPIN. Bull. Soc. d'obst. et de gynéc. de Par., 1925., xiv, 305.

An ovarian carcinoma with a twisted pedicle and fatal intraperitoneal hæmorrhage. E. A. SCHUMANN. Am. J. Obst. & Gynec., 1925, x, 273.

A carcinomatous ovarian teratoma with premature puberty and precocious somatic development. R. H. HARRIS. Surg., Gynec. & Obst., 1925, xli, 191.

Unusual modes of dissemination of ovarian carcinoma. I. LEVIN and B. JOSEPH. Arch. Clin. Cancer Research, 1925, i, 51.

A case of ovarian hydatid mole. P. MOLLER and A. ALS-NIELSEN. Acta gynec. Scand., 1925, iii, 325.

The intramural portion of the tube. A. HERMSTEIN and B. NEUSTADT. Ztschr. f. Geburtsh. u. Gynaek., 1924, lxxxviii, 43.

The escape of blood from the tube during menstruation. M. BEHREND. Zentralbl. f. Gynaek., 1925, xlix, 1007.

The mechanism of axial rotation of the tube. H. GROSSMANN. Zentralbl. f. Gynaek., 1925, xlix, 1001.

Nodular isthmic salpingitis. A. SOIMARU. Bull et mém. Soc. anat. de Par., 1925, xcv, 79.

Suppurative adnexitis due to the pneumococcus; colpotomy; recovery. A. SOIMARU. Bull. et mém. Soc. anat. de Par., 1925, xcv, 77.

The therapeutic action of carbon dioxide insufflation of the fallopian tubes. G. L. MOENCH. Med. Herald, 1925, xliv, 179.

Salpingostomy. A. MAYER. Muenchen. med. Wchnschr., 1925, lxxii, 671.

Tubal rupture without ectopic pregnancy. A. SOIMARU. Bull. et mém. Soc. anat. de Par., 1925, xcv, 83.

External Genitalia

Elephantiasis of the vulva. G. THEODORESCO. Gynec. si obst., 1925, iii, 24.

Kraurosis vulvæ. H. RAPPAPORT and A. M. CHAIRMAN. Med. Times, 1925, liii, 189.

Radiation and electrocoagulation of the vulva and clitoris. B. F. SCHREINER. Arch. Clin. Cancer Research, 1925, i, 47.

The genesis of tumors of the urethrovaginal septum. E. BIÖRKLUND. Acta gynec. Scand., 1925, iii, supp.

A degenerated fibroma of the vesicovaginal septum. VAUTRIN and GUILLEMIN. Bull Soc. d'obst. et de gynéc. de Par., 1925, xiv, 331.

The hydrogen-ion concentration in the vaginal secretion. H. GAENSSLE. Arch. f. Gynaek., 1925, cxxiii, 602.

The resistance of vaginal bacteria as a measure of their virulence. N. C. LOUROS and E. M. FUSS. Klin. Wchschr., 1925, iv, 698.

Congenital atresia of the vagina. P. B. SALATICH. Am. J. Obst. & Gynec., 1925, x, 279.

A severe vaginal erosion from chloride of zinc. H. NAUJOKS. Arch. f. Gynaek., 1925, cxxiii, 765.

Thrush colpitis and its treatment. S. STEPHAN. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxix, 65.

A report of thirty-three cases of cancer of the vagina treated by radiation. B. F. SCHREINER. Arch. Clin. Cancer Research, 1925, i, 41.

Miscellaneous

The gynecology of tomorrow, with some remarks on uterine retrodisplacement. G. G. WARD. Ohio State M. J., 1925, xxi, 481. **[464]**

The demonstration of the female sex hormone in the circulating blood. I. Preliminary report. R. T. FRANK, M. L. FRANK, R. G. GUSTAVSON, and W. W. WEYERTS. J. Am. M. Ass., 1925, lxxxv, 510. [464]

Psychogenic causes of bodily symptoms in gynecology and obstetrics. A. MAYER. Zentralbl. f. Gynaek., 1925, xlix, 785.

Gynecological psychotherapy. W. LIEPMANN. Berlin: Urban & Schwarzenberg, 1924.

Biology and pathology of the female: Handbook of gynecology and obstetrics. Vol. IV. Part 14. J. HALBAN and L. SEITZ. Embryology of man from the germ cell to the formation of the external body form. O. GROSSER. The anatomy and physiology of the fetus and the biology of the placenta. H. A. DIETRICH. Berlin: Urban & Schwarzenberg, 1925.

Clinical and experimental studies on the growth of the genital organs. H. GUGGISBERG. Schweiz. med. Wchnschr., 1925, lv, 114.

An atlas of operative anatomy and pathology of the female sexual organs, with particular reference to the course of the ureter and of the suspensory and supporting apparatus of the uterus. W. LIEPMANN. Berlin: Urban & Schwarzenberg, 1924.

Absence of the internal genital organs and seminoma. DUPONT. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 275.

Symptoms associated with the menstrual cycle and the effects thereon of ovarian therapy. H. SHARLIT, J. A. CORSCADEN, and W. G. LYLE. Am. J. Obst. & Gynec., 1925, x, 246. [464]

Vicarious menstruation following the artificial menopause. R. J. GROOM. Colorado Med., 1925, xxii, 288.

Symmetrical dysmenorrhœal dermatitis and toxicosis of menstruation. S. A. SELITZKY. Beitr. z. Prob. d. Gynaek. u. d. Carcin., 1925.

The clinical importance of climacteric hæmorrhages. M. HENKEL. Deutsche med. Wchnschr., 1925, li, 507.

Female sterility. E. DOUAY. Gynéc. et obst., 1925, xi, 283.

Influencing the fertility of the female white rat by treatment with placental tissue. F. KOVACS. Am. J. Obst. & Gynec., 1925, x, 232. [465]

The treatment of sterility by diathermy. C. A. CASTAÑO. Gynéc. et obst., 1925, xi, 207.

Roentgen examination in gynecology and obstetrics. C. REIFFERSCHEID. Leipzig: Barth, 1924.

The hæmogram in gynecology. K. SOMMER. Ztschr. f. Geburtsh. u. Gynaek., 1925, lxxxviii, 658.

The treatment of secondary anæmia by blood transfusion preceding operation for myoma uteri and pelvic inflammatory disease. B. M. ANSPACH and H. W. JONES. Am. J. Obst. & Gynec., 1925, x, 222. [465]

Gynecological backache. E. LISSACK. J. Missouri State M. Ass., 1925, xxii, 303.

Prolapse of the female urethra. A. JACOBY. Med. J. & Rec., 1925, cxxii, 131.

Vaccine therapy in gynecology. R. HOFSTAETTER. Med. Klin., 1925, xxi, 609.

The treatment of gonorrhœa in women. F. A. PEMBERTON. Boston M. & S. J., 1925, cxciii, 415.

Basic principles in the vaccine treatment of gonorrhœa in women. F. WOLFF. Beitr. z. Prob. d. Gynaek. u. d. Carcin., 1925, 89.

The recognition and permanence of cure of gonorrhœa in the female, with particular reference to stimulation studies. J. BERTSCHY. Dermat. Wchnschr., 1924, lxxviii, 428, 454.

Tuberculosis of the female genitalia. W. WEIBEL. Wien. med. Wchnschr., 1925, lxxv, 637, 811.

A pelvic cyst after subtotal abdominal hysterectomy. HALLER. Paris chir., 1925, xvii, 179.

Radio-active substances and their therapeutic uses and applications; the radiotherapy of benign lesions of the female generative tract. J. MUIR. Radiology, 1925, v, 147.

Radiation treatment in gynecological carcinoma. F. PORDES. Muenchen. med. Wchnschr., 1925, lxxii, 653.

Chorionepithelioma malignum. C. S. BARNES and J. H. CLARK. Am. J. Obst. & Gynec., 1925, x, 278.

The priority and technique of some celebrated gynecological vaginal operations. A. DUEHRSSEN. Arch. f. Gynaek., 1925, cxxiii, 452.

Local anæsthesia in gynecological operations. J. FRIGUESSY. 11 ung. Chirurgentag., Budapest, 1924.

Lumbar anæsthesia and gynecological operations. W. KROENIG. Zentralbl. f. Gynaek., 1925, xlix, 696.

Lumbosacral anæsthesia in gynecological operations. M. SEIDLER. Zentralbl. f. Gynaek., 1925, xlix, 1040.

Arterial decortication in gynecology. R. AHRENS. Zentralbl. f. Gynaek., 1925, xlix, 912.

OBSTETRICS

Pregnancy and Its Complications

The human ovum, its implantation, the closure of the implantation opening, and the development of the germ in man before the formation of the primitive streak. W. VON MOELLENDORFF. Ztschr. f. d. ges. Anat. u Entwicklungsgesch., 1925, lxxvi, 16.

The molecular biology and pathology of pregnancy. L. SEITZ. Arch. f. Gynaek., 1925, cxxiv, 27.

The normal mass in the female pelvis which is covered with soft tissue. L. LITTEN. Zentralbl. f. Gynaek., 1925, xlix, 817.

The early diagnosis of pregnancy and the Maturin test. P. SCHUMACHER. Ztschr. f. Gebursh u. Gynaek., 1924, lxxxviii, 334.

Phloridzin glycosuria and its value in the diagnosis of pregnancy. R. KRAEUTER. Med. Klin., 1925, xxi, 278.

Pelvimetry of the superior strait by means of the roentgen ray. H. THOMS. J. Am. M. Ass., 1925, lxxxv, 253. [466]

Interfereometry as a diagnostic measure in obstetrics and gynecology. A. STRECK. Zentralbl. f. Gynaek., 1925, xlix, 968.

The care of pregnancy. W. C. DANFORTH. Boston M. & S. J., 1925, cxciii, 331.

A symposium on prenatal care. H. M. RUBEL. Kentucky M. J., 1925, xxiv, 395.

Is rectal examination in obstetrics to be recommended in general practice? T. JOHANNSEN. Zentralbl. f. Gynaek., 1925, xlix, 534.

Extension of the use of rectal examination. A. REIST. Zentralbl. f. Gynaek., 1925, xlix, 629.

The possibility of decreasing the danger of obstetrical examination. H. SELLHEIM. Med. Klin., 1925, xxi, 359.

Diet during pregnancy; especially its modification in the prevention of toxæmia. W. I. PRICHARD. Virginia M. Month., 1925, lii, 315.

The duration of pregnancy. J. E. BAZÁN. Semana méd., 1925, xxxii, 1061.

The length of pregnancy and the development of the child. A. HEYN. Muenchen. med. Wchnschr., 1925, lxxii, 185.

The length of pregnancy and the development of the child. RISSMANN. Muenchen. med. Wchnschr., 1924, lxxi, 1797.

Abnormal duration of pregnancy in man and animals. G. SCHWARZ. Zentralbl. f. Gynaek., 1925, xlix, 905.

Short-term pregnancy. A. HEYN. Arch. f. Gynaek., 1925, cxxiii, 534.

The treatment of high lying positions. B. BAUCH. Zentralbl. f. Gynaek., 1925, xlix, 821.

Incarceration of the retroflexed uterus at the fourth month. J. FOTITCH. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 288.

Incarceration of the retroflexed pregnant uterus. THOMAS. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 343.

Axial torsion of a pregnant myomatous uterus. P. RIEHL. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 340.

The etiology, symptoms, and treatment of tubal pregnancy. K. MILLER. Deutsche Ztschr. f. Chir., 1924, clxxxviii, 165.

A probably ectopic pregnancy developing in a stump of the tube after oöphorosalpingectomy. LOUBAT and ICHON. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 300.

A tubal pregnancy after secondary abdominal pregnancy. F. MANN. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxix, 45.

Appendicitis and tubal pregnancy. TUSSAU. Paris chir., 1925, xvii, 182.

Bilateral tubal pregnancy. W. R. BRACEY. Virginia M. Month., 1925, lii, 311.

A case of tubal abortion with the formation of an anteuterine hæmatocele and concomitant decompensation of a mitral stenosis. RIEHL. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 338.

Abdominal pregnancy; intervention; living child. LACOUTURE and L. MASSÉ. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 294.

The cotyledon of the human placenta. F. KERMAUNER. Ztschr. f. Geburtsh. u. Gynaek., 1924, lxxxviii, 396.

Fibrin and fibrinoid in the placenta. O. GROSSER. Ztschr. f. Anat. u. Entwicklungsgesch., 1925, lxxvi, 304.

Uteroplacental apoplexy; total hysterectomy without opening of the ovum. AUDEBERT and FOURNIER. Gynec. et obst., 1925, xi, 81.

Tumor of the placenta. THOMAS. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 341.

Studies of premature rupture of the membranes. F. PARIS. Dissertation: Frankfort, 1924.

Further observations concerning premature separation of the normally implanted placenta. J. W. WILLIAMS. J. Obst. & Gynæc. Brit. Emp., 1925, xxxii, 259. **[466]**

Recurrence of premature separation of the placenta. ÉPARVIER. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 324.

Placenta prævia. W. BALLHORN. Arch. f Gynaek., 1925, cxxiii, 646.

A case of placenta prævia with a placenta reflexa in the last months of pregnancy. R. JAHREIS. Zentralbl. f. Gynaek., 1925, xlix, 920.

Hæmorrhage in the last trimester of pregnancy. H. C. BURGESS. Am. J. Obst. & Gynec., 1925, x, 49. **[467]**

The fixation of the fetal head during the latter part of pregnancy: a comparison between primiparæ and multiparæ. P. WETTERDAL. Acta gynec. Scand., 1925, iii, 207. **[467]**

Generalized hydrops of the fetus. F. BANG. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 285.

General hydrops of the fetus with œdema and albuminuria in the mother. GINGLINGER. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 336.

Habitual death of the fetus. A. J. GUIROY. Semana méd., 1925, xxxii, 1158.

Intra-uterine retrogressive changes in the fetus. J. UMBACH. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxviii, 283.

Iniencephalus—a cause of extreme dystocia. W. A. N. DORLAND. Surg., Gynec., & Obst., 1925, xli, 180.

Obstetrical roentgenology with special reference to anencephaly. H. P. DOUB. Am. J. Roentgenol., 1925, xiv, 39. **[468]**

Retention of the dead ovum and polyp-like tumors of the placenta. COMMANDEUR and DAUJAT. Bull Soc. d'obst. et de gynéc. de Par., 1925, xiv, 307.

Malformation and the conditions for the interruption of pregnancy; i. e., sterilization. R. HESSBERG. Ztschr. f. Augenh., 1925, liv, 355.

Interruption of pregnancy and criminal jurisdiction. A. NIEDERMEYER. Zentralbl. f. Gynaek., 1925, xlix, 992.

Abortion by poisons and other means. L. LEWIN. Berlin: Stilke, 1925.

Abortions and their treatment. S. KOBRINSKY. Canadian M. Ass. J., 1925, xv, 789.

The treatment of abortion. O. VON FRANQUÉ. Med. Klin., 1925, xxi, 425.

Staphylococcic scpticopyæmia with multiple localizations after a miscarriage. GONNET and MOREL. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 322.

The treatment of miscarriage. E. VOGT. Med. Klin., 1925, xxi, 307.

Electrical trauma and pregnancy. S. JELLINEK. Beitr. z. gerichtl. Med., 1924, vi, 29.

The treatment of extensive œdema of the vulva in pregnancy. O. HOEHNE. Deutsche med. Wchnschr., 1925, li, 57.

Dilatation of the ureter and kidney pelvis during pregnancy: a pyelographic study. H. L. KRETSCHMER and N. S. HEANEY. J. Am. M. Ass., 1925, lxxxv, 406. **[468]**

Uterine rupture at the eighth month of pregnancy in a woman having had two previous cæsarean sections. DUJOL. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 322.

A case of rare indication for ovariectomy in pregnancy (stimulation of an ovarian tumor by a fibroma of the corpus luteum). S. KUSUDA. Arch. f. Gynaek., 1925, cxxiv, 269.

Multiple uterine fibromata; a dermoid cyst of the ovary; a five months' pregnancy; total hysterectomy. COMMANDEUR and PATEL. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 317.

A case of diabetes insipidus coexisting with a tumor of the breast and pregnancy. A. LORENTE SANZ. Clin. y. lab., 1925, v, 418.

Pregnancy complicated by primary tuberculosis. H. B. MATHEW. Rev. de gynec. e d'obst., 1925, xix, 181.

Tuberculosis in pregnant women; our experiences. C. MOENCKEBERG and J. M. VERGARAK. Gynéc. et obst., 1925, xi, 241.

Syphilis and pregnancy—prenatal care. R. L. DE NORMANDIE. Boston M. & S. J., 1925, cxciii, 392.

Pregnancy and carcinoma. K. SOMMER. Zentralbl. f. Gynaek., 1925, xlix, 758.

Cancer of the uterine cervix and pregnancy. P. FERRAZINI. Rev. méd. d. Rosario, 1925, xv, 67.

The phenoltetrachlorphthalein test in pregnancy. J. WATSON. Rev. méd. d. Rosario, 1925, xv, 85.

The treatment of pyelitis in pregnancy. T. HEYNEMANN. Therap. d. Gegenw., 1925, lxvi, 16.

The use of glucose and insulin in the treatment of obstetrical and postoperative acidosis. Q. B. LEE. Texas State J. M., 1925, xxi, 250.

The toxæmias of pregnancy. S. SELITZKY. Gynéc. et obst., 1925, xi, 91.

Fetal protein intoxication—the fundamental factor in the vomiting of pregnancy—a preliminary report. W. S. HORN. Texas State J. M., 1925, xxi, 180. [468]

The etiology of pre-eclamptic toxæmia from a clinical aspect. E. CARY. Surg., Gynec. & Obst., 1925, xli, 194. [468]

An increase in the depth of respiration as a sign of the pre-eclamptic stage. E. KLAFTEN. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxix, 164.

Pre-eclamptic toxæmia complicated by pyelitis and pulmonary disease. W. E. LEVY. Am J. Obst. & Gynec., 1925, x, 287.

Early eclampsia. M. L. PÉREZ and A. M. BREA. Semana méd., 1925, xxxii, 1165.

Observations and experiences with eclampsia. W. POTEN. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxix, 25.

Syphilis and eclampsia. T. J. GONZÁLEZ. Semana méd., 1925, xxxii, 1105.

Hot water in eclampsia. O. KIENE and R. E. WEAVER. Therap. Gaz., 1925, 3 s. xli, 560.

Hyperemesis gravidarum. P. TITUS. J. Am. M. Ass., 1925, lxxxv, 488. [469]

Intractable vomiting and ovarian cysts. VORON and PIGEAUD. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 316.

The treatment of intractable vomiting of pregnancy. J. CAMARGO. Rev. de gynec. e d'obst., 1925, xix, 178.

Labor and Its Complications

Observations on normal labor. G. FROMMOLT. Zentrabl. f. Gynaek., 1925, xlix, 979.

The anatomical basis of rupture of the membranes in normal and premature labors. L. BELOSOR. Zentralbl. f. Gynaek., 1925, xlix, 644.

Clandestine labor, spontaneous rupture of the umbilical cord. GINGLINGER. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 335.

Modern aids to labor. W. B. HENDRY. J. Iowa State M. Soc., 1925, xv, 434.

Rectal examination during labor and its importance to the practicing physician. W. KROENIG. Arch. f. Gynaek., 1925, cxxiii, 542.

The question of internal examination by the midwife. L. FELDMANN. Muenchen. med Wchnschr., 1925, lxxii, 475.

Pituitrin in obstetrics. T. K. VAN ZANDT. Kentucky M. J., 1925, xxiv, 399.

A certain method of testing hypophyseal preparations. W. H. TREUTER. Zentralbl. f. Gynaek., 1925, xlix, 831.

Rectal ether analgesia in childbirth. J. A. HARRAR. Am. J. M. Sc., 1925, clxx, 256.

The use of narcylene for anæsthesia in obstetrics. H. BEHRENDT and J. H. MAIER. Muenchen. med. Wchnschr., 1925, lxxii, 672, 734.

Investigation with somnifène in obstetrics. F. SIEGERT. Zentralbl. f. Gynaek., 1925, xlix, 748.

Forceps. W. T. MCCONNELL. Kentucky M. J., 1925, xxiv, 401.

Some personal experiences with Kjelland's forceps. E. HAUCH. Gynéc. et obst., 1925, xi, 321.

Experiences with the Kjelland forceps. C. EISENBERG. Med. Klin., 1924, xx, 1694.

A note on Kjelland's forceps. BRINDEAU and LANTUÉJOUL. Gynéc. et obst., 1925, xi, 199.

The use of the Kjelland forceps in high breech presentation. J. KELEN. Zentralbl. f. Gynaek., 1925, xlix, 871.

Advantages and disadvantages of the Kjelland forceps. R. ZIMMERMANN. Klin. Wchnschr., 1925, iv, 600.

Occiput posterior. B. C. HIRST. South. M. J., 1925, xviii, 616.

Version, its indications and contra-indications. H. E. MILLER. Am. J. Obst. & Gynec., 1925, x, 241.

Neglected shoulder presentation; attempt at version; complete laceration of the vaginal vault; total hysterectomy. LEROUX. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 282.

Brow presentation, an attitude of deflection, with the history of a case of spontaneous brow transverse. D. A. CALHOUN. Am. J. Obst. & Gynec., 1925, x, 266.

The frequency of decapitation in transverse presentation, and a new method of performing this operation. I. FREID. Zentralbl. f. Gynaek., 1925, xlix, 874.

A large fibroma prævia; rupture of the bag of waters thirty-six hours previously; total hysterectomy *en bloc* followed by cæsarean section; a living child; death of the mother from tetanus on the twenty-second day. P. SAPPEY. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 314.

Observations on dry labor. L. M. RANDALL. Minnesota Med., 1925, viii, 525.

The question of the danger of infection in manual r-moval of the placenta. H. KATZ. Wien. klin. Wchnscher. 1925, xxxviii, 90.

The indication for cæsarean section. H. A. DAVIDSON, Kentucky M. J., 1925, xxiv, 403.

The limitations of cæsarean section. C. J. MILLER. Am. J. Obst. & Gynec., 1925, x, 260.

Postmortem cæsarean section with a living child in a patient dying during an eclamptic convulsion. S. D. JACOBSON. Am. J. Obst. & Gynec., 1925, x, 289.

Extraperitoneal vaginal cæsarean section. F. HEINSIUS. Zentralbl. f. Gynaek., 1925, xlix, 763.

Repeated cæsarean section in a case of oblique oval pelvis of Nœgelé. M. RIVIÈRE and M. RIVIÈRE. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 303.

The cæsarean scar. O. H. SCHWARZ and R. PADDOCK. Am. J. Obst. & Gynec., 1925, x, 153.

Spontaneous rupture of the uterus during labor; abdominal hysterectomy; drainage à la Mickulicz. DUCAROS. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 289.

Spontaneous rupture in transverse presentation with predisposing inflammatory changes in the uterine wall. H. HELLENDALL. Zentralbl. f. Gynaek., 1925, xlix, 606.

Inversion of the uterus; a report on three cases and an analysis of 233 recently recorded cases. W. MCK. H. MCCULLAGH. J. Obst. & Gynaec., Brit. Emp., 1925, xxxii, 280. [469]

Abnormality of the third period of labor, particularly hæmorrhage after labor. H. BAUMM. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxix, 113.

Acute yellow atrophy of the liver during labor. F. GROSS. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxviii, 244.

Rational operative procedures in obstetrics. H. E. MILLER. N. Orleans M. & S. J., 1925, lxxviii, 88.

Subcutaneous symphyseotomy according to Frank's technique. F. KLEE. Ztschr. f. Geburtsh. u. Gynaek., 1925, lxxxviii, 574.

Gyneplastic repairs following childbirth. J. L. BUBIS. Am. J. Obst. & Gynec., 1925, x, 213.

Puerperium and Its Complications

Prophylaxis in the puerperium, particularly in the prevention of atony and chilling after labor. F. LICHTENSTEIN. Muenchen. med. Wchnschr., 1925, lxxii, 585.

Œdema and hypertrophy of the cervic uteri during the puerperium. A. TURENNE. Surg., Gynec. & Obst., 1925, xli, 156.

Puerperal uterine hæmorrhage associated with malaria. DUCAROS. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 292.

Bleeding as a result of small placental rests which had been left in the uterus. L. S. PETERSEN. Acta dermatol. Scand., 1925, iii, 307.

Some problems in the bacteriology of puerperal sepsis. J. EELES. Edinburgh M. J., 1925, n. s. xxxii, Edinburgh Obst. Soc., 115.

Puerperal septicæmia and pulmonary gangrene. A. RIOTTE. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 345.

Hysterectomy with drainage in postpartum puerperal infection. DUCAROS. Bull Soc. d'obst. et de gynéc. de Par., 1925, xiv, 290.

Essential puerperal ischuria. KIRSTEIN and SCHWIEDER. Arch. f. Gynaek., 1925, cxxiii, 503.

Late and early manifestations of pyelonephritis in the course of the puerperium. RHENTER. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 311.

Puerperal eclampsia. J. DECOURT. Med. Press, 1925, n. s. cxx, 111.

Magnesium sulphate in the treatment of puerperal eclampsia. R. CLÉMENT. Presse méd., Par., 1925, xxxiii, 646.

Newborn

The baby. F. J. KIEFFER. Kentucky M. J., 1925, xxiv, 405.

A study of the weight and dimensions of the human placenta in its relation to the weight of the newborn infant. F. L. ADAIR and H. THELANDER. Am. J. Obst. & Gynec., 1925, x, 172.

Preliminary report of a study of infant mortality in a certain community. J. D. DONNELLY. Atlantic M. J., 1925, xxviii, 732.

Birth trauma and its significance in psycho-analysis. O. RANK. Leipzig: Internat. psychoanalyt. Verl., 1924.

The spinal fluid in the newborn. M. H. ROBERTS. J. Am. M. Ass., 1925, lxxxv, 500.

Statistics on the relation of clinical symptoms in the newborn to birth trauma. D. RADOSLAWOW. Dissertation: Frankfort, 1924.

Transfusion in the newborn; technique; indications; and results. G. BARBARO. Gynéc. et obst., 1925, xi, 119.

Blood transfusion in debilitated premature infants. P. GUÉNIOT and SÉGUY. Gynéc. et obst., 1925, xi, 111.

Progress in pediatrics: icterus neonatorum. S. VAN CREVELD. Am. J. Dis. Child., 1925, xxx, 240.

Sinking of the frontal bone; reposition à la Vicarelli. PLAUCHU and SAUTEREAUX. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 310.

Hydrocephalus with dorsolumbar spina bifida and supernumerary organs. GONNET, MOREL, and BERARD. Bull. Soc. d'obst. et de gynéc. de Par., 1925, xiv, 321.

Fetus amorphus; report of a case. J. P. SIMONDS and G. A. GOWEN. Surg., Gynec. & Obst., 1925, xli, 171.

Neonatal pyelitis. L. W. SAUER. J. Am. M. Ass., 1925, lxxxv, 327.

Sclerema neonatorum (a case report). W. E. ALLYN. Clin. Med., 1925, xxxii, 541.

Intracranial hæmorrhage in newborn. C. G. GRULEE. J. Am. M. Ass., 1925, lxxxv, 336.

Meningeal hæmorrhages in the newborn. A. GORDON. J. Med. Soc. N. Jersey, 1925,xxii, 294.

Clinical pseudo-bulbar paralysis due to intracranial hæmorrhage of the newborn. C. EDMOND. Virginia M. Month., 1925, lii, 300.

A case of monochorea in two-ovum twins. R. O. VON VERSCHUER. Muenchen. med. Wchnschr., 1925, lxxii, 184.

Miscellaneous

Obstetrics. Ed. 8. R. T. VON JASCHKE. Leipzig: Buchhandl. d. Verb. d. Aerzte Deutschlands, 1925.

Ideals of obstetrical work. J. W. D. HOOPER. Med. J. Australia, 1925, ii, 104.

Progress in obstetrics. W. C. BECKER. Nebraska State M. J., 1925, x, 315.

Conservation in obstetrics. G. B. FOSCUE. Texas State J. M., 1925, xxi, 247.

The relationship of dentistry to obstetrics. H. S. SHULMAN. Dental Cosmos, 1925, lxvii, 739.

GENITO-URINARY SURGERY

Adrenal, Kidney, and Ureter

Chromaffin cell tumor of the adrenal medulla (paraganglioma). I. T. ZECKWER. Boston M. & S. J., 1925, cxciii, 254.

The present lack of knowledge regarding the recognition and treatment of perinephritic abscess. G. MARION. J. d'urol. méd. et chir., 1925, xix, 140. [471]

The relative parts played by the cortex and medulla in the symptoms following extirpation of the adrenals. A. BORNSTEIN and H. GREMELS. Arch. f. path. Anat. u. Physiol., 1925, ccliv, 409.

The determination of kidney function in private practice. G. H. AGNEW. Canadian M. Ass. J., 1925, xv, 778.

The sensitivity of the phenolsulphonephthalein test for renal function. R. LÉVY and M. NEGRO. J. d'urol. méd. et chir., 1925, xix, 208. [471]

The influence of scopolamine-morphine narcosis on renal function. R. W. W. BARNES. Urol. & Cutan. Rev., 1925, xxix, 459.

Movable kidney. W. L. DOWNING. J. Iowa State M. Soc., 1925, xv, 441.

Renal anomalies. J. A. QUINTANA, J. DANTE, and E. L. LANARI. Rev. Soc. argent. de urol., 1925, i, 42.

A case of a third kidney with its own ureter. K. FISCHER and K. ROSENLOECHER. Ztschr. f. urol. Chir., 1925, xvii, 61.

The report of a case of left kidney in the true pelvis; anomaly of the vessels and of the kidney pelvis. DERVIEUX and PIÉDELIÈVRE. Bull. et mém. Soc. anat. de Par., 1925, xcv, 56.

High lumbar ectopia of the left kidney with the right in the normal position. J. SALLERAS and J. A. BLACKSLEY. Semana méd., 1925, xxxii, 1161.

Congenital dilatation of the tubules of the kidney. PAPIN and VERLIAC. J. d'urol. méd. et chir., 1925, xix, 445.

Seven cases of hydronephrosis. G. SOEDERLUND. Acta chirurg. Scand., 1925, lix, 100.

Gigantic hydronephrosis with hydro-ureters, congenital. E. H. KESSLER. J. Missouri State M. Ass., 1925, xxii, 314; Radiology, 1925, v, 163.

The diagnosis and treatment of chronic renal infections in women. H. M. GINSBERG. Therap. Gaz., 1925, 3 s. xli, 561.

The acidosis of severe nephritis. P. DELORE. Arch. d. mal. d. reins et d. organes génitaux-urinaires, 1925, ii, 168.

An unusual experience with nephrectomy for suppurative nephritis. F. KAMMERER. Surg., Gynec. & Obst., 1925, xli, 70. [472]

New cystoscopic signs of renal tuberculosis and its localization. L. E. PAGLIERE. Rev. Soc. argent. de urol., 1925, i, 27.

My experiences with operative exploration of the kidney on one side before nephrectomy on the other in advanced cases of renal tuberculosis. G. EKEHORN. Hygiea, Stockholm, 1924, lxxxvi, 353, 386.

Echinococcus of the kidney in Dalmatians. J. RAČIĆ. Ztschr. f. urol. Chir., 1925, xvii, 163.

Necrosis of the renal cortex and of the spleen in eclampsia. P. GEIPEL. Arch. f. Gynaek., 1925, cxxiv, 231.

Nephrolithiasis. G. R. LIVERMORE. South. M. J., 1925, xviii, 603.

A renal calculus in a child of 5 years. A. PULIDO MARTIN. Siglo méd., 1925, lxxii, 469.

Ureteral stricture. E. A. FLETCHER, W. M. KEARNS, and W. A. LIEBELER. Wisconsin M. J., 1925, xxiv, 66. [472]

A study of urinary stasis in ureteral obstructions. A. E. GOLDSTEIN. J. Urol., 1925, xiv, 33. [472]

Metastatic carcinoma of the ureter associated with ureteral stricture. W. J. CARSON. Ann. Surg., 1925, lxxxii, 142. [473]

Bladder, Urethra, and Penis

Studies on the bladder and ureters, with special reference to regurgitation of the vesical contents; regurgitation as observed in cats and dogs. R. C. GRAVES and L. M. DAVIDOFF. J. Urol., 1925, xiv, 1. [473]

Hernia of the bladder. R. E. FARR and C. W. BRUNKOW. Ann. Surg., 1925, lxxxii, 264. [473]

Urethral hernia of the bladder. ST. J. W. DANSEY. Med. J. Australia, 1925, ii, 137.

The irritable bladder. W. L. BAZEMORE. J. Med. Ass. Georgia, 1925, xiv, 312.

Observations on the etiology and treatment of cystitis. H. W. B. CAIRNS. Brit. J. Surg., 1925, xiii, 78. [474]

Some problems of the treatment of gonorrhœal spermatocystitis. N. E. ARONSTAM. Urol. & Cutan. Rev., 1925, xxix, 462.

Cystic inflammation of the vesical neck and of the prostatic urethra. J. A. LAZARUS. Surg., Gynec. & Obst., 1925, xli, 162.

Ulcers of the bladder. E. H. KING. California & West. Med., 1925, xxiii, 1030. [474]

Diverticula of the bladder as a cause of prolonged gonorrhœal infection—case report. A. W. NELSON. Cincinnati J. M., 1925, vi, 303.

A clinical study of eleven cases of vesical diverticula. R. O. WARD. Brit. J. Surg., 1925, xiii, 144. [474]

A review of the subject of stenosis of the neck and of the bladder. C. H. CHETWOOD. Urol. & Cutan. Rev., 1925, xxix, 457.

The diagnosis and treatment of vesical calculus. L. W. BREMERMAN and G. L. GUNDRY. Cincinnati J. M., 1925, vi, 284.

Some points of operative technique in cystostomy. LE FUR. Paris chir., 1925, xvii, 151.

The probable stimulation in the rate of growth of a cancer of the bladder by deep X-ray therapy. MARTIN. J. d'urol. méd. et chir., 1925, xix, 232. [474]

A case of pseudogonococcal urethritis; some reflexions on sperm culture. MORAN. J. d'urol. méd. et chir., 1925, xix, 428.

Posterior urethritis and urinary neurasthenia. BRANDINO CORRÊA. Arch. brasil. de med., 1925, xv, 199.

Tuberculosis of the urethra with particular reference to the stricture forming type. S. RICHTER. Acta chirurg. Scand., 1925, lix, 237. [474]

Impassible strictures of the urethra; resection of the inflammatory mass by the Albarran-Heitz-Boyer method. P. BAZY. J. d'urol. méd. et chir., 1925, xix, 377.

Two cases of impassible stricture of the bulbar urethra. J. SALLERAS. Rev. Soc. argent. de urol., 1925, i, 30.

Urethral pouches. G. P. B. HUDDY. Brit. J. Surg., 1925, xiii, 50. [474]

Genital Organs

The problem of the benign prostate. E. O. SWARTZ. Cincinnati J. M., 1925, vi, 272.

The prostate and its influence on low back pain. L. P. PLAYER. California & West. Med., 1925, xxiii, 993. [475]

Chronic prostatitis. J. K. HOLLOWAY and W. H. VON LACKUM. Med. J. & Rec., 1925, cxxii, 23, 64. [475]

Prostatic abscess. L. HERMAN and J. CARP. Ann. Surg., 1925, lxxxi, 1115. [475]

Tuberculosis developing on a prostatic adenoma. LEGUEU and VERLIAC. J. d'urol. méd. et chir., 1925, xix, 441.

X-ray treatment of prostatic hypertrophy. N. CÁNOVAS. Siglo méd., 1925, lxxii, 500.

A new diathermy punch operation for prostatic obstruction. K. M. WALKER. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Urol., 35.

A new technique for prostatectomy. ISQUIERDO. Paris chir., 1925, xvii, 184.

Suprapubic prostatectomy in bad surgical risks. L. HERMAN. Atlantic M. J., 1925, xxviii, 657. [476]

Subcapsular perineal prostatectomy according to the Wildboltz method. SERÉS and M. IBARTZ. Clin. y lab., 1925, v, 369.

The use of the combined hypogastric and perineal routes in difficult prostatectomy. X. DELORE, J. DE ROUGEMONT, and J. CREYSSEL. J. d'urol. méd. et chir., 1925, xix, 398.

Prostatic deaths. F. S. SCHOONOVER. South. M. J., 1925, xviii, 607.

How can we lower the mortality of prostatectomy and improve the end-results? D. N. EISENDRATH. J. Indiana State M. Ass., 1925, xviii, 281.

Persistent pyuria following prostatectomy. J. A. LAZARUS. Am. J. Surg., 1925, xxxix, 190.

Primary spindle-cell sarcoma of the prostate. M. STERN. Arch. Clin. Cancer Research, 1925, i, 91.

Skeletal metastasis in carcinoma of the prostate. D. E. EHRLICH. Arch. Clin. Cancer Research, 1925, i, 75.

Adrenalin tissue in contact with the spermatic cord in a child. R. TILLIER, LEBON-TESTOUD, and FRANCERIES. Bull. et mém. Soc. anat. de Par., 1925, xcv, 44.

A loose body in the tunica vaginalis. A. E. SAWDAY. Lancet, 1925, ccix, 220.

Hæmorrhagic inflammation of the tunica vaginalis with abscess of the testis. MAUCLAIRE and FLIPO. Bull. et mém. Soc. anat. de Par., 1925, xcv, 51.

A tuberculous ectopic testis. MAUCLAIRE and VIGNERON. Bull. et mém. Soc. anat. de Par., 1925, xcv, 38.

Tumors of the testicle: the teratoid group. F. G. BELL. Brit. J. Surg., 1925, xiii, 7. [476]

Carcinoma of the testis. J. L. AMSTER. Arch. Clin. Cancer Research, 1925, i, 23.

Syphilitic hydrocele of the newborn. B. SPARACIO. Riforma med., 1925, xli, 462.

Miscellaneous

Handbook of special pathological anatomy and histology. F. HENKE and O. LUBARSCH. Vol. VI. The urinary organs;

the male sex organs. T. FAHR, G. B. GRUBER, M. KOCH, O. LUBARSCH, and O. STOERK. Berlin: Springer, 1925.

Teaching of urology to interns. W. C. QUINBY. J. Am. M. Ass., 1925, lxxxv, 558.

Recent clinical studies in urology. G. L. HUNNER. Urol. & Cutan. Rev., 1925, xxix, 447.

Roentgenological examination of the genito-urinary tract by the injection of lipiodol. E. L. ŁANARI and A. ASTRALDI. Rev. Soc. argent. radio y electrol., 1925, i, 39.

Back pain of urological origin. L. MICHEL. Am. J. Surg., 1925, xxxix, 186.

Iodized oil as a pyelographic medium. C. H. NEUSWANGER. J. Am. M. Ass., 1925, lxxxiv, 1816. **[477]**

Experimental polyuria. SIR E. SHARPEY-SCHAFER. Brit. M. J., 1925, ii, 185.

Two cases of cystinuria in children with renal and vesical cystin calculi respectively. J. F. H. STALLMAN. Lancet, 1925, ccix, 375.

The significance of pus in the urine. J. L. WHITE. Texas State J. M., 1925, xxi, 260.

The management and control of venereal diseases. H. J. PERRY. Boston M. & S. J., 1925, cxciii, 381.

The treatment of gonorrhœa. A. E. MOWRY. Illinois M. J., 1925, xlviii, 128.

The treatment of chronic gonorrhœa. L. A. SCHREIBER. Crón. méd., Lima, 1925, xlii, 154.

The treatment of gonorrhœa in the male. G. G. SMITH. Boston M. & S. J., 1925, cxciii, 412.

Heat in the treatment of gonorrhœa in the male. D. A. BROWN. Am. J. Surg., 1925, xxxix, 188.

Gonococcic vaccines and urotropin. E. ALVAREZ SÁINZ DE AJA. Clin. y lab., 1925, v, 415.

Mercurochrome-220 soluble in genito-urinary diseases. F. H. REDEWILL and J. E. POTTER. J. Am. M. Ass., 1925, lxxxiv, 1891. **[477]**

Contribution to the question of bladder and kidney stones in Dalmatia. J. RAČIĆ. Ztschr. f. urol. Chir., 1925, xvii, 127.

Renal, ureteral, and urethral calculi. S. WALLENSTEIN. Med. J. & Rec., 1925, cxxii, 152.

The treatment of cystin stone. J. U. REAVES. South. M. J., 1925, xviii, 599.

Further observations on kidney and bladder stones, with special reference to recurrence. C. O. DELANEY. South. M. & S., 1925, lxxxvii, 490.

A review of urological surgery. A. J. SCHOOL, E. S. JUDD, L. D. KEYSER, G. S. FOULDS, and J. VERBRUGGE. Arch. Surg., 1925, xi, 304.

Paravertebral anæsthesia in urology. M. SIROVICZA. 11. ung. Chirurgentag., Budapest, 1924.

Local anæsthesia in orthopedic surgery. N. ZINNER. 11. ung. Chirurgentag., Budapest, 1924.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

Conditions of the Bones, Joints, Muscles, Tendons, Etc.

A case of unilateral chondromatosis (Ollier's disease). J. W. F. JANSEN. Acta radiol., 1925, iv, 133.

Congenital curvature of the long bones and generalized hydrops. FRIDTJOF BANG. Gynéc. et obst., 1925, xi, 356.

An analysis of bone and joint lesions of known syphilitic origin. W. C. CAMPBELL. Radiology, 1925, v, 122.

The treatment of fibrocystic osteitis. M. DUGUET. Bull. et mém. Soc. nat. de chir., 1925, li, 192.

Acute osteomyelitis and its relation to the general practitioner. R. T. CONGDON. Northwest Med., 1925, xxiv, 385.

Chronic osteomyelitis in infants. J. RENZ. Arch. f. Kinderh., 1925, lxxv, 308.

Effective treatment of osteomyelitis by aluminum-potassium nitrate. M. THOREK. Illinois M. J., 1925, xlviii, 112.

Bone tuberculosis. L. A. TAMINI. Rev. méd. Lat.-Am., 1925, x, 885.

X-ray treatment of bone tuberculosis. J. D. SOUTHARD. Radiology, 1925, v, 34. **[479]**

Radiation treatment of bone tumors. W. E. COSTOLOW. Radiology, 1925, v, 37. **[479]**

A case of bone tumor. J. B. H. WARING. Virginia M. Month., 1925, lii, 318.

Enchondroma of the large bones. SATANOWSKY. Bol. y trab. Soc. de cirug. de Buenos Aires, 1925, ix, 127.

Multiple myeloma. H. W. MEYERDING. Radiology, 1925, v, 132.

Multiple cartilaginous exostoses. R. A. BLACK and A. S. TRAISMAN. Arch. Pediat., 1925, xlii, 530.

Bone regeneration. H. KOCH. Arch. f. klin. Chir., 1925, cxxxv, 48.

The recognition of latent infection preceding operations on the skeletal system. KUNTZEN. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

The action of collateral ligaments, with remarks on so-called snapping joints. O. AICHEL. Ztschr. f. Anat. u. Entwicklungsgesch., 1925, lxxvi, 1.

A case of acute scarlet polyarthritis. R. MAZA. Rev. de med. y cirug., Caracas, 1925, viii, 91.

The histopathology and pathogenesis of free joint bodies. J. SEGOVIA. Arch. de med., cirug. y especial., 1925, xix, 289.

Menge's arthropathia ovaripriva. O. FLIEGEL and R. STRAUSS. Zentralbl. f. Gynaek., 1925, xlix, 633.

The treatment of anterior poliomyelitis. J. A. TALBOTT. Virginia M. Month., 1925, lii, 216. **[479]**

Successful research in the treatment of infantile paralysis. G. M. LEVICK. Lancet, 1925, ccix, 323.

The residual paralysis and deformity of anterior poliomyelitis. J. I. MITCHELL. J. Bone & Joint Surg., 1925, vii, 619. **[479]**

Congenital elevation of the scapula. J. CUNHA. An. Fac. de med., Univ. de Montevideo, 1925, x, 307.

A case of fibrous cystic osteitis of the humerus. LAGOUTTE. Lyon chir., 1925, xxii, 238.

Case report of a chondroma of the humerus necessitating interscapulothoracic amputation. W. SPICKERS. J. Med. Soc. N. Jersey, 1925, xxii, 283.

A case of post-traumatic osteoma of the brachial triceps. N. BARBILIAN. Bull. et mém. Soc. anat. de Par., 1925, xcv, 92.

Double longitudinal fissure of the inferior epiphysis of the radius. A. MOUCHET and A. C. BEY. Bull. et mém. Soc. anat. de Par., 1925, xcv, 135.

A case of Madelung's deformity. J. GARRIDO-LESTACHE. Pediat. español, 1925, xiv, 138.

Clinical record—maldevelopment of the wrist and hand. L. ROGERS. Edinburgh M. J., 1925, n.s. xxxii, 407.

Unilateral wrist drop due to syphilis, with reports of cases. T. P. MURDOCK. Am. J. Syphilis, 1925, ix, 566.

An unusual skeletal anomaly, fusion of the semilunar and pyramidal bones. A. BASSET. Bull. et mém. Soc. nat. de chir., 1925, li, 277.

Some accessory carpal bones and their surgical significance. A. HEIMERZHEIM. Deutsche Ztschr. f. Chir., 1925, cxc, 88.

Aplasia of single interphalangeal joints. L. STECHER. Arch. f. klin. Chir., 1925, cxxxiv, 818.

Osteochondritis of the second metatarsophalangeal joint (with discussion). A. GOTTLIEB. California & West. Med., 1925, xxiii, 1019.

A successful thumb plastic from the great toe of the opposite side. W. PORZELT. Arch. f. klin. Chir., 1925, cxxxv, 340.

An ossifying chondroma of the rib mistaken for sarcoma. C. P. G. WAKELEY. Brit. J. Surg., 1925, xiii, 175. [480]

Dorsal kyphosis of adolescence. C. MAU. Muenchen. med. Wchnschr., 1925, lxxii, 211.

Rachialgia, vertebral deformity; meningolysis. LAROYENNE and MICHEL. Lyon chir., 1925, xxii, 228.

The evolution of vertebral rheumatism from cellulitis and exostosis. F. REGNAULT. Bull. et mém. Soc. anat. de Par., 1925, xcv, 67.

Vertebral epiphysitis. P. LEWIN. Ann. Surg., 1925, lxxxii, 286.

Painful kyphosis and vertebral epiphysitis. MATHIEU, MASSART, and DUCROQUET. Bull. et mém. Soc. nat. de chir., 1925, li, 220.

Cervical Pott's disease—Albee graft. TAVERNIER. Lyon chir., 1925, xxii, 274.

A congenital mixed tumor of the lumbosacral region associated with spina bifida occulta. SONNTAG. Muenchen. med. Wchnschr., 1925, lxxii, 516.

The significance of fissure formation in the bony spinal canal in the etiology of orthopedic pain. H. MEYER. Ztschr. f. orthop. Chir., 1925, xlvi, 107.

A new case of spina bifida occulta operated upon. NOVÉ-JOSSERAND. Lyon chir., 1925, xxii, 287.

Four cases of occult spina bifida operated upon. NOVÉ-JOSSERAND. Lyon chir., 1925, xxii, 264.

Two cases of hemisacralization of the fifth lumbar vertebra. R. MASSART and R. DUCROQUET. Bull. et mém. Soc. anat. de Par., 1925, xcv, 42.

Vertebral changes in diseases of the spinal canal. GOLD. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

Cysts of the iliopsoas bursa. W. D. GATCH and W. T. GREEN. Ann. Surg., 1925, lxxxii, 277.

The non-tuberculous hip of early life. J. A. KEY. J. Missouri State M. Ass., 1925, xxii, 295.

Discussion on the differential diagnosis of non-tuberculous coxitis in children and adolescents. A. H. TODD, R. C. ELMSLIE, R. JONES, and others. Proc. Roy. Soc. Med., Lond., 1925, xviii, Sect. Orthop., 31. [480]

Osteochondritis of the hip. TAVERNIER. Lyon chir., 1925, xxii, 233.

Osteochondritis coxæ juvenilis and tuberculous coxitis. HEINER. Ztschr. f. orthop., 1925, xlvi, 266.

The roentgenogram of osteochondritis deformans juvenilis coxæ and of related diseases. P. CAAN. Fortschr. a. d. Geb. d. Roentgenstrahlen., 1925, xxxiii, 223.

Tuberculosis of the hip in children. H. E. COE. Med. J. & Rec., 1925, cxxii, 143.

Dry arthritis of the hip. NOVÉ-JOSSERAND. Lyon chir., 1925, xxii, 230.

Changes in the acetabulum in arthritis deformans. F. J. LANG. Arch. f. path. Anat., 1924, cclii, 578.

An unusual X-ray finding in the epiphysis of the femoral head in a child. F. LOEFFLER. Zentralbl. f. Chir., 1925, lii, 961.

Traumatic cysts of the head of the femur, a contribution to the question of the importance of ligamentum teres for the nutrition of the head of the femur. E. STEDEN. Muenchen. med. Wchnschr., 1925, lxxii, 517.

Five cases of spina ventosa of the femur. R. MASSART and R. DUCROQUET. Bull. et mém. Soc. anat. de Par., 1925, xcv, 93.

Melanosarcoma of the lower end of the femur. VEILLET. Bull. et mém. Soc. anat. de Par., 1925, xcv, 22.

The partite patella. H. HELLMER. Acta radiol., 1925, iv, 137.

Bipartite patella. L'HEUREUX. Bull. et mém. Soc. anat. de Par., 1925, xcv, 40.

Some cases of lesions of the knee. D. PRAT. An. Fac. de med., Univ. de Montevideo, 1925, x, 348.

Traumatic lesions of the menisci of the knee. BRESSOT. Lyon chir., 1925, xxii, 218.

Hæmangiomata of the knee joint. J. T. O'FERRALL. J. Am. M. Ass., 1925, lxxxv, 505.

Osteoma of the capsule of the knee joint. S. SIMON. Deutsche Ztschr. f. Chir., 1925, cxc, 116.

The question of osteochondritis dissecans of the knee joint. VON DITTRICH. Ztschr. f. orthop. Chir., 1925, xlvi, 270.

A note on the tibial spine. A. MOUCHET and A. NOUREDDINE. Bull. et mém. Soc. anat. de Par., 1925, xcv, 58.

Suppurative tabetic arthroplasty of the tibiotarsal region after spontaneous fracture of the internal malleolus. MAUCLAIRE and FLIPO. Bull. et mém. Soc. anat. de Par., 1925, xcv, 54.

A case of talalgia. NOVÉ-JOSSERAND. Lyon chir., 1925, xxii, 212.

Flat-foot. G. ENGELMANN. Wien. med. Wchnschr., 1925, lxxv, 693.

A sling for flat-foot. ZUR VERTH. Ztschr. f. orthop. Chir., 1925, xlvi, 310.

Pes cavus and its treatment. O. STRACKER. Wien. med. Wchnschr., 1924, lxxiv, 2519.

The treatment of club-foot. P. MATHIEU. Bull. et mém. Soc. nat. de chir., 1925, li, 338.

Isolated disease of the tarsal scaphoid (Kohler's disease): end-results in treated and untreated cases. F. E. DIEMER and F. E. BUTLER. Radiology, 1925, v, 159.

Surgery of the Bones, Joints, Muscles, Tendons, Etc.

The relation of orthopedic surgery to general medicine. J. T. O'FERRALL. N. Orleans M. & S. J., 1925, lxxviii, 71.

Twenty years of orthopedic surgery in Zwickau/Sa. K. GAUGELE. Stuttgart: Enke, 1925.

The treatment of chronic suppurations, particularly of bones. M. THOREK. Med. J. & Rec., 1925, cxxii, 132.

The treatment of chronic bone suppurations. M. THOREK. Paris chir., 1925, xvii, 187.

The site and method of amputation and its orthopedic care. H. VON RENESSE. Muenchen. med. Wchnschr., 1925, lxxii, 521.

Pirogoff's amputation. H. VON RENESSE. Arch. f. orthop. u. Unfall-Chir., 1925, xxiii, 549.

An unusual phenomenon in amputation stumps. H. HERFARTH. Fortschr. a. d. Geb. d. Roentgenstrahlen, 1925, xxxiii, 221.

End-results in 100 cases of anterior poliomyelitis operated on at the Fordham Hospital. S. W. BOORSTEIN. Surg., Gynec. & Obst., 1925, xli, 149.

A case of infectious arthritis. N. J. NESSA. Radiology, 1925, v, 167.

The treatment of tuberculous joints in children. P. C. COLONNA. Med. J. & Rec., 1925, cxxii, 155.

The treatment of tuberculous arthritis by means of bone transplantation. M. BASTOS ANSART. Prog. de la clin., Madrid, 1925, xxxi, 590.

The treatment of suppurative arthritis. D. TADDEI. Riforma med., 1925, xli, 481.

The production of joint ankylosis. HASS. Ztschr. f. orthop. Chir., 1925, xlvi, 301.

Skin-flap methods in the upper extremity. A. STEINDLER. J. Bone & Joint Surg., 1925, vii, 512. [481]

The transolecranon route applied to aseptic traumatic lesions of the elbow. ALGLAVE. Paris chir., 1925, xvii, 191.

The Whitman reconstruction operation on the hip joint. M. B. COOPERMAN. Med. J. & Rec., 1925, cxxii, 194.

Arthroplasty of both knees. LAROYENNE. Lyon chir., 1925, xxii, 211.

A simple method for elevating the depressed anterior metatarsal arch. B. H. KYLE. Virginia M. Month., 1925, lii, 310.

The cure of pes equinus and the prevention of recurrence by rotation osteotomy in congenital club-foot. F. LOEFFLER. Arch. f. klin. Chir., 1925, cxxxiv, 457.

Fractures and Dislocations

The preservation and restoration of function in fractures and dislocations. R. T. TAYLOR. Am. J. Surg., 1925, xxxix, 177. [481]

The indications and contra-indications for osteosynthesis. DUPUY DE FRENELLE. Paris chir., 1925, xvii, 148.

The end-results of osteosynthesis. A. LAMBOTTE. Bull. et mém. Soc. nat. de chir., 1925, li, 463. [482]

The final results of osteosynthesis. A. LAMBOTTE. Paris chir., 1925, xvii, 188.

Influence of periarterial sympathectomy on the evolution of fractures and osteo-articular tuberculosis. COTTE. Lyon chir., 1925, xxii, 280.

The roentgen studies of habitual dislocation of the shoulder. W. PILZ. Arch. f. klin. Chir., 1925, cxxxv, 1.

Old unreduced dislocation of the shoulder; report of operative case with resection of head of the humerus. G. L. MCWHORTER. Surg. Clin. N. Am., 1925, v, 1019.

Osteosynthesis for fracture of the upper end of the humerus. SANTY. Lyon chir., 1925, xxii, 268.

Fractures of the upper end of the humerus in a child treated by osteosynthesis. VIGNARD and PERRIN. Lyon chir., 1925, xxii, 271.

Fractures about the elbow joint. B. L. SCHOOLFIELD. Texas State J. M., 1925, xxi, 244.

Neuritis of the ulnar nerve as a complication of fracture of the elbow. ARCE. Bol. y trab. Soc. de cirug. de Buenos Aires, 1925, ix, 131.

The treatment of compound fractures of the forearm. A. ASPINALL. Med. J. Australia, 1925, ii, 135.

Fractures of the forearm: their non-operative treatment. L. G. TEECE. Med. J. Australia, 1925, ii, 132.

Unusual combination of a fracture of the metacarpus and of the wrist. A. MOUCHET and A. C. BEY. Bull. et mém. Soc. anat. de Par., 1925, xcv, 136.

Fracture of the os hamatum. ESAU. Fortschr. a. d. Geb. d. Roentgenstrahlen, 1925, xxxiii, 201.

Dislocations of the semilunar carpal bone. H. E. CONWELL. Ann. Surg., 1925, lxxxii, 289.

Displacement of the semilunar carpal bone; an analysis of twelve cases. J. D. ADAMS. J. Bone & Joint Surg., 1925, vii, 665. [482]

Fracture of the carpal navicular bone. K. SPEED. J. Bone & Joint Surg., 1925, vii, 682. [482]

Avulsion fracture of the anterior superior spine of the ilium. W. KUEHNAST. Arch. f. orthop. u. Unfall-Chir., 1925, xxiii, 460.

Malformations and subluxations of the hip. G. NOVÉ-JOSSERAND. Rev. d'orthop., 1925, xxxii, 85. [482]

The causes of new joint formation in so-called congenital luxations of the hip. H. MEYER. Ztschr. f. orthop. Chir., 1925, xlvi, 192, 214.

Late luxation and reluxation of the hip. HASS. Ztschr. f. orthop. Chir., 1925, xlvi, 135, 214.

Contracture of the hip in unreduced dislocations. SAXL. Ztschr. f. orthop. Chir., 1925, xlvi, 147, 214.

Observations on the pathology and treatment of old congenital luxations of the hip. PITZEN. Ztschr. f. orthop. Chir., 1925, xlvi, 202, 214.

The indications for the operative treatment of old luxations of the hip. WULLSTEIN. Ztschr. f. orthop. Chir., 1925, xlvi, 163, 214.

The treatment of irreducible congenital luxations of the hip. NATZLER. Ztschr. f. orthop. Chir., 1925, xlvi, 195, 214.

A bifurcation operation for the treatment of irreducible dislocations of the hip joint. R. S. REICH. J. Bone & Joint Surg., 1925, vii, 598. [483]

Open operation in an adult for irreducible fracture-dislocation of the hip. J. H. JOPSON. Ann. Surg., 1925, lxxxii, 304.

Experiences in the operative treatment of irreducible luxations of the hip and coxa vara. HACKENBROCH. Ztschr. f. orthop. Chir., 1925, xlvi, 185, 214.

Experiences with deep osteotomy of the femur according to Schanz in old congenital luxations of the hip. MOMMSEN. Ztschr. f. orthop. Chir., 1925, xlvi, 188, 214.

Epiphyseal separation at the lower end of the femur. G. RIEDEL. Zentralbl. f. Chir., 1925, lii, 978.

The architecture and the blood supply of the head and neck of the femur and their importance in the pathology of fractures of the neck. A. KOLODNY. J. Bone & Joint Surg., 1925, vii, 575. [483]

The pathological anatomy of fracture of the femoral neck. F. HESSE. Arch. f. klin. Chir., 1925, cxxxiv, 141.

The treatment of fracture of the femur. R. WHITMAN. Med. J. & Rec., 1925, cxxii, 191.

Elongation of the patellar ligament in recurring dislocation of the patella. TAVERNIER. Lyon chir., 1925, xxii, 258.

The use of fascia lata in the operative treatment of recent fracture of the patella. R. SEUBERT. Zentralbl. f. Chir., 1925, lii, 692.

A case of osteosynthesis for a complicated fracture of the leg. H. JUDET. Paris chir., 1925, xvii, 175.

End-results to illustrate the value of fixed traction in the treatment of fractures of the lower extremity. H. W. ORR and J. E. M. THOMSON. J. Bone & Joint Surg., 1925, vii, 696. [484]

Operative technique in condylar fractures of the tibia. P. BROCQ and G. PANIS. J. de chir., 1925, xxv, 417. [484]

Auto-injection of blood after metatarsal fracture. W. LEWY. Med. Klin., 1925, xxi, 627.

Orthopedics in General

Exercise and orthopedics. VON BAEYER. Ztschr. f. orthop. Chir., 1925, xlvi, 24, 59.

Changes in the physical structure of the blood plasma following orthopedic methods of treatment. KNORR. Ztschr. f. orthop. Chir., 1925, xlvi, 113.

The value of rapidity of sedimentation of red cells in orthopedics. H. WATERMANN. Ztschr. f. orthop. Chir., 1925, xlvi, 117.

Duchenne-Trendelenburg phenomena. BECK. Ztschr. f. orthop. Chir., 1925, xlvi, 207.

The treatment of spontaneous movements (chorea and athetosis) in cerebral paralysis of children. SILFVERSKIOELD. Ztschr. f. orthop. Chir., 1925, xlvi, 245.

The orthopedic management of atactic disturbances of gait in tabes dorsalis. GRAF. Ztschr. f. orthop. Chir., 1925, xlvi, 69.

The possibilities of physiotherapy in the prevention and treatment of paralysis following anterior poliomyelitis. E. B. KESSLER. J. Radiol., 1925, vi, 318.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

Blood Vessels

Experimental investigations on the effect of the roentgen-rays upon the blood vessels. GABRIEL. Fortschr. a. d. Geb. d. Roentgenstrahlen, 1924, xxxii, 158, 168. **[486]**

Blood-vessel injuries, with observations on traumatic segmental spasm of the arteries and traumatic thrombosis of the subclavian vein. O. WINTERSTEIN. Schweiz. med. Wchnschr., 1925, lv, 360.

Capillary microscopic studies in traumatic surgery. O. HOCHE and B. PFAB. Zentralbl. f. Chir., 1925, lii, 794.

The topographical anatomy of the carotid arteries. K. Z. JAZUTA. Anat. Anz., 1925, lix, 148.

Disease of the coronary arteries. M. H. NATHANSON. Am. J. M. Sc., 1925, clxx, 240.

A case of aortic insufficiency of arterial origin. P. M. ITURBE. Rev. de med. y cirug., Caracas, 1925, viii, 124.

A case of embolism of the bifurcation of the aorta. M. SOMALO. Semana méd., 1925, xxxii, 1050.

A dissecting aneurism with signs of aortic insufficiency: report of a case in which the aortic valves were normal. W. H. RESNIK and C. S. KEEFER. J. Am. M. Ass., 1925, lxxxv, 422.

Arteriovenous fistula. T. H. THOMASON. Ann. Surg., 1925, lxxxii, 293.

Abnormal arteriovenous communications, acquired and congenital. III. The effects of abnormal arteriovenous communications on the heart, blood vessels, and other structures. M. R. REID. Arch. Surg., 1925, ii, 25. **[486]**

Abnormal arteriovenous communications, acquired and congenital. IV. The treatment of abnormal arteriovenous communications. M. R. REID. Arch. Surg., 1925, xi, 237. **[487]**

Spontaneous arteriovenous aneurism in the thorax. T. SHENNAN. Edinburgh M. J., 1925, n.s. xxxii, 410.

Three cases of aneurism treated by wiring. G. H. COLT, C. J. MARSHALL, and C. P. G. WAKELEY. Brit. J. Surg., 1925, xiii, 109. **[489]**

Aneurism of the right hypogastric artery, mistaken for an inflammatory adnexal tumor. H. C. BRUNNER. Zentralbl. f. Gynaek., 1925, xlix, 603.

A case of ligation of the innominate artery. M. JUCKELSON. Zentralbl. f. Chir., 1925, lii, 681.

An attempt at arteriovenous anastomosis of the femoral vessels for senile gangrene. MAUCLAIRE and FLIPO. Bull. et mém. Soc. anat. de Par., 1925, xcv, 53.

The symptomatology of the diseases of the vessels of the extremities in the light of their pathology. L. BUERGER. Ann. Clin. Med., 1925, iv, 54. **[489]**

Vascular syndromes in the extremities. T. M. FOLEY. Virginia M. Month., 1925, lii, 297.

The treatment of varicose veins. LINSER. Therap. d. Gegenw., 1925, lxvi, 19.

Experimental investigation of local disturbances of the circulation. J. TANNENBERG. Frankfurt. Ztschr. f. Path., 1925, xxxi, 173, 182, 351.

Gangrene of the hand and forearm probably due to embolism. P. SÉJOURNET. Bull. et mém. Soc. anat. de Par., 1925, xcv, 48.

Remarks on arteriosclerotic and thrombo-arteritic gangrene. L. ELOESSER. Deutsche Ztschr. f. Chir., 1924, clxxxix, 95.

Three cases of embolectomy. R. TORELL. Acta chirurg. Scand., 1925, lix, 171. **[490]**

Blood; Transfusion

The recognition of the hormone in blood. H. BOCK. Munich: Pflaum, 1924.

Sero-hæmo-flocculation. A. PRUNELL. An. Fac. de med., Univ. de Montevideo, 1925, x, 427.

The immediate postprandial variations in the rapidity of the sedimentation of the erythrocytes. S. BLACHOWSKY. Presse méd., Par., 1925, xxxiii, 626.

Experimental studies of the effect of intravenous injections of lipoid substances on the leucocyte content of the blood. S. BERGEL. Ztschr. f. d. ges. exper. Med., 1924, xxxix, 509.

The recognition of occult hæmorrhages by means of the pyramidon reaction. F. JOSEPH. Deutsche med. Wchnschr., 1925, li, 150.

Hæmophilia and anæmia due to malaria. G. R. GONZALO. Siglo méd., 1925, lxxii, 530.

Hæmophilia—an interesting case. A. A. CONRAD. Nebraska State M. J., 1925, x, 305.

Physicochemical aspects of hæmolysis. III. A further study of some of the factors involved. R. ROCKWOOD and E. C. MASON. J. Lab. & Clin. Med., 1925, x, 917.

The rôle of the transfusion department in a modern hospital organization. M. L. JANES. Modern Hosp., 1925, xxv, 105.

The precipitin reaction of fibrinogen. L. HEKTOEN and W. H. WELKER. J. Am. M. Ass., 1925, lxxxv, 434.

Surgical indications for blood transfusions. C. C. SMITH. South. M. & S., 1925, lxxxvii, 488.

The choice of a donor for the transfusion of large quantities of blood. P. SCHUMACHER. Arch. f. Gynaek., 1925, cxxiii, 569.

Simple apparatus for blood transfusion. H. M. FEINBLATT. Med. J. & Rec., 1925, cxxii, 143.

Clinical and pathologico-anatomical observations on women whose blood has been transfused according to Oehlecker's method: a contribution to the question of the danger of direct blood transfusion. P. SCHUMACHER. Ztschr. f. Geburtsh. u. Gynaek., 1925, lxxxviii, 591.

Death from blood transfusion and its prevention. P. SCHNEIDER. Zentralbl. f. Gynaek., 1925, xlix, 900.

Lymph Vessels and Glands

The treatment of tuberculous glands. E. SORREL. Med. Press, 1925, n. s. cxx, 130.

SURGICAL TECHNIQUE

Operative Surgery and Technique; Postoperative Treatment

Tannic acid in the treatment of burns. E. C. DAVIDSON. Surg., Gynec. & Obst., 1925, xli, 20. **[491]**

The use of paraffin as a primary dressing for skin grafts. F. A. COLLER. Surg., Gynec. & Obst., 1925, xli, 221. **[491]**

Postoperative pulmonary complications. P. G. BOMAN. Minnesota Med., 1925, viii, 517.

Postoperative acetonuria and diaceturia. G. NOGARA. Ann. ital. di chir., 1925, iv, 415.

Antiseptic Surgery; Treatment of Wounds and Infections

Further observations on the effect of nutrition upon wound infection and wound healing. HERRMANNSDORFER. 49 Tag. d. deutsch. Ges. f. Chir., Berlin, 1925.

Considerations on the use of mercurochrome. PONS and P. ZAMORA. Rev. de med. y cirug. de la Habana, 1925, xxx, 301.

The intravenous use of mercurochrome-220 soluble; case report. C. S. BUCHER and R. S. FUNK. Illinois M. J., 1925, xlviii, 135.

Some results of vaccine therapy. J. LASCOMBE. Rev. de chir., Par., 1925, xliv, 363.

Anæsthesia

The use of hypnosis in surgery and its allied specialties. A. HAAS. Arch. f. klin. Chir., 1925, cxxxv, 23.

The anæsthesia department of a hospital. C. N. COMBS. Modern Hosp., 1925, xxv, 112.

The narcotic action of pure ether. BIJLSMA. Klin. Wchnschr., 1925, iv, 622.

Ethylene as an anæsthetic agent. A. B. LUCKHARDT. Klin. Wchnschr., 1925, iv, 739.

Somnifène as an anæsthetic in obstetrics and surgery. A. B. LANGÓN. An. Fac. de med., Univ. de Montevideo, 1925, x, 464.

Observations on 400 narcylen anæsthesias. K. HURLER. Muenchen. med. Wchnschr., 1925, lxxii, 468.

Experiences with narcylen anæsthesia. KURTZAHN. Arch. f. klin. Chir., 1924, cxxxiii, 152.

The alleged synergism of magnesium sulphate and morphine. H. BECKMAN. J. Am. M. Ass., 1925, lxxxv, 332.

Subcutaneous anæsthesia with pantoponscopolamine. M. CASTAÑEDA. Crón. méd., Lima, 1925, xlii, 167.

Local anæsthesia. J. KIRÁLY. II. ung. Chirurgentag., Budapest, 1924.

Local anæsthesia, its scientific principle and practical application. H. BRAUN. Leipzig: Barth, 1925.

Burlanesco's method in local anæsthesia. C. WESKAMP. Rev. méd. d. Rosario, 1925, xv, 129.

Ethylene anæsthesia. L. R. ALLEN. Colorado Med., 1925, xxii, 327.

Tutocain, a new local anæsthetic. F. LUNIATSCHEK. Deutsche Monatsschr. f. Zahnh., 1925, xliii, 179.

Posterior sacral anæsthesia. W. S. PUGH. Med. Times, 1925, liii, 191.

Three cases of resuscitation of the heart after anæsthetic syncope, the one permanent, the others temporary, by the intracardiac injection of adrenalin. T. ASTERIADES. Presse méd., Par., 1925, xxxiii, 629.

A case of resuscitation by intracardiac injection of adrenalin in acute postoperative arrest of the heart. A. SCHAPIRA. Zentralbl. f. Chir., 1925, lii, 798.

Intracardiac injections of adrenalin in the treatment of syncope resulting from anæsthesia. R. DE VEGA BARRERA. Arch. de med., cirug. y especial., 1925, xix, 390.

Surgical Instruments and Apparatus

Oil sterilization of edged instruments. F. H. LAHEY and R. L. MASON. Surg., Gynec. & Obst., 1925, xli, 226.

PHYSICOCHEMICAL METHODS IN SURGERY

Roentgenology

Education in roentgenology. P. M. HICKEY. J. Am. M. Ass., 1925, lxxxv, 557.

The biological effect of radiation; studies of the ascaris ovum exposed to ultraviolet, roentgen, and radium rays. J. SEIDE. Ztschr. f. wissensch. Zool., 1925, cxxiv, 252.

The biological effect of the roentgen rays. F. PORDES. Strahlentherapie, 1925, xix, 307.

The effect of roentgen rays on metabolic processes. DAVID. Fortschr. a. d. Geb. d. Roentgenstrahlen, 1924, xxxii, 156, 168.

The effect of roentgen rays on the blood and metabolic rate. KOEPCHEN. Fortschr. a. d. Geb. d. Roentgenstrahlen, 1924, xxxii, 156, 168.

A portable instrument for the measurement and registration of X-ray intensity. R. M. SIEVERT. Acta radiol., 1925, iv, 129.

The percentage deep dosage and its relation to the μ co-efficient. Z. SZILARD. Dissertation: Frankfort, 1924.

An objective method for the administration of X-rays. G. FAILLA. Acta radiol., 1925, iv, 85.

Radiotherapy in bronchial asthma. G. MONER. Rev. Soc. argent. radio y electrol., 1925, i, 19.

Recurring chronic eczema treated by radiotherapy. M. M. GALLINO and H. M. TERRADA. Rev. Soc. argent. radio y electrol., 1925, i, 29.

The roentgen treatment of so-called surgical tuberculosis. F. PORDES. Extrapulmonale Tuberkul., 1925, i, 15.

The results of radiation treatment of skin carcinoma. W. F. WASSINK and C. P. WASSINK VAN RAAMSDONK. Acta radiol., 1925, iv, 146.

A collection of material for the study of accidents and injuries in roentgen ray work. F. M. GROEDEL, H. LINIGER, and H. LOSSEN. Fortschr. a. d. Geb. d. Roentgenstrahlen, 1925, xxxvi, 1. [493]

The necessity for, and time of application of, surgical treatment in inflammations which have been subjected to radiation therapy. F. PORDES. Wien. klin. Wchnschr., 1925, xxxviii, 487.

Radium

Special uses of radium. C. D. WRIGHT. J.-Lancet, 1925, xlv, 357.

Iso-doses of various radium and mesothorium preparations and combinations and their use in radiation therapy. E. HUTH. Strahlentherapie, 1925, xix, 358.

Shock from large doses of radium. E. JONQUIÈRES. Rev. Soc. argent. radio y electrol., 1925, i, 12.

Radium therapy in dermatology. G. A. ROBINSON. Am. J. Roentgenol., 1925, xiv, 130.

The limitations of radium therapy in dermatology. L. R. TAUSSIG. Am. J. Roentgenol., 1925, xiv, 121.

The action of beta and gamma rays on guinea pigs. DE JONG. Gynéc. et obst., 1925, xi, 250.

A preliminary report on the use of an absorbable filter with bare tubes of radium emanation. A. C. HEUBLEIN and D. QUICK. Am. J. Roentgenol., 1925, xiv, 116. [493]

Miscellaneous

How a small hospital establishes a physiotherapy department. E. S. MOORE. Modern Hosp., 1925, xxv, 103.

Some results of light therapy. H. C. SEMON. Practitioner, 1925, CXV, 112.

Artificial sunlight treatment. W. J. O'DONOVAN. Practitioner, 1925, CXV, 119.

Heliotherapy in the treatment of tuberculosis. H. LOGRASSO. Therap. Gaz., 1925, 3 s. xli, 539.

Experiences with ultra light rays without heat rays. E. KLEEMANN. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxviii, 268.

The practical methods of dosage of ultraviolet rays. L. HILL. Practitioner, 1925, CXV, 102.

Some observations on the dosage of ultraviolet rays in artificial sun treatment. A. EIDINOW. Lancet, 1925, ccix, 317. [493]

Action of ultraviolet light upon the growth of rats. M. E. HUME. Brit. M. J., 1925, ii, 341.

The general effect of radiation of mucous membrane with ultraviolet light. A. LAQUEUR and H. WIENER. Med. Klin., 1925, xxi, 242.

Quantitative data in tissue reactions to ultraviolet radiations. P. R. PEACOCK. Lancet, 1925, ccix, 369.

Diathermy. J. KOWARSCHIK. Berlin: Springer, 1924.

MISCELLANEOUS

Clinical Entities—General Physiological Conditions

Conditions of shock and the specificity of thermal treatment. A. LIACRE. Presse méd., Par., 1925, xxxiii, 661.

Non-specific cold abscesses. E. MELCHIOR. Beitr. z. klin. Chir., 1925, cxxxiii, 205.

A case of actinomycosis. W. ERSNER. Dental Cosmos, 1925, lxvii, 756.

Hydatid cysts. A. ROLDÁN. An. Fac. de med., Univ. de Montevideo, 1925, x, 291.

A fibrolipoma in an unusual location. P. BARCO. Ann. ital. di chir., 1925, iv, 430.

Pigmented tumors. G. CARISI. Riforma med., 1925, xli, 457.

A histological study of melanotic tumors and the effect of radiation treatment upon them. A. A. THIRAUDEAU and B. F. SCHREINER. Arch. Clin. Cancer Research, 1925, i, 29.

Precancerous conditions and the meaning of prevention in cancer. I. LEVIN. Arch. Clin. Cancer Research, 1925, i, 3.

The effect of prepuberty castration on subsequent cancer implantation. J. B. MURPHY and E. STURM. J. Exper. Med., 1925, xlii, 155.

The serum diagnosis of carcinoma. A. VON WASSERMANN. Verhandl. f. Verdauungs-u. Stoffwechselkrankh., 1925, 3.

The activation of the mesenchyma, and a contribution on the local vital staining of malignant tumors in man. W. VON GAZA. Klin. Wchnschr., 1925, iv, 745.

The etiology of malignant new growths. W. E. GYE. Lancet, 1925, ccix, 109. [495]

The microscopical examination of filterable viruses associated with malignant new growths. J. E. BARNARD. Lancet, 1925, ccix, 117. [495]

The diagnosis of carcinoma (the phosphoric acid content of the blood, Kahn's reaction, and the blood-sugar picture). F. BERNHARD. Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1924, xxxviii, 204.

The metabolism of carcinoma cells. O. WARBURG. Klin. Wchnschr., 1925, iv, 534.

The mechanism of the formation and growth of malignant tumors. A. CARREL. Ann. Surg., 1925, lxxxii, 1. [496]

The tissue reaction against growing carcinoma. VON GAZA. 49 Tag. d. deutsche. Ges. f. Chir., Berlin, 1925.

The effect of electrical currents upon epithelial and cancer cells. E. DELBANCO. Dermat. Wchnschr., 1924, lxxix, 1595.

The transplantation of distant skin flaps for the cure of intractable basal-cell carcinoma. J. S. HORSLEY. Ann. Surg., 1925, lxxxii, 14. [496]

On the radiation biology of carcinoma. OPITZ. Brit. J. Radiol., 1925, xxx, 252. [497]

Granuloma inguinale. R. R. BEST. Ann. Surg., 1925, lxxxii, 273.

Borderline sarcoma with myeloplaxes. TAVERNIER. Lyon chir., 1925, xxii, 256.

General Bacterial, Mycotic, and Protozoan Infections

Cellular immunity and its effects on the development and treatment of constitutional and infectious diseases. A. THEILHABER. Berlin: Pilger, 1925.

Hereditary tuberculosis. C. MOENCKERBERG and J. M. VERGARAK. Gynéc. et obst., 1925, xi, 331.

Heliotherapy and experimental and surgical tuberculosis. P. LEONE. Riforma med., 1925, xli, 460.

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THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

By ALFRED J. BROWN, M.D., F.A.C.S., Omaha, Nebraska

THE SURGERY OF HERNIA BY PIERRE FRANCO[1]

NOT very much is known of the life of this man, Pierre Franco, who was one of the most original surgeons of the sixteenth century. In his writings he gives a few facts and others have been gathered here and there. He was born in 1500 in the town of Turriers in Provence a little west of the border of Switzerland. Of his early education we know only that he picked up his surgery from the itinerant herniotomists, lithotomists, and operators on cataract. These three operations he practiced throughout his life but brought them to a state of perfection far beyond that of his teachers and though he probably belonged to the class of itinerant surgeons in his early years, eventually as his knowledge, experience, and skill increased he came to despise this class of practitioner. His first book, "A little Treatise containing one of the principal parts of surgery, which surgeons call hernia," was published in 1556 while he was living and practicing in Switzerland and had been in the service of the government of Berne for 10 years to which the government of Lausanne where he lived was subject. Why he left France for Switzerland is not known, but as he was a Protestant it is reasonable to infer that it was due to religious difficulties and not from choice, for in 1561 when his second book was published he is found back in southern France again living and practicing in Orange where he remained until his death, the exact date of which is not known.

Franco's second book was a great advance over his first effort and shows the development which he must have undergone as the result of his own experience and effort. That he studied anatomy is apparent not only from his work but also from the fact that he presented to the cities of Berne, Freiburg, and Lausanne, skeletons which he had mounted himself. That he had done considerable reading is shown by his references to the ancient writers and to those of the middle ages and in this alone he had advanced far out of the class of his teachers. In this second publication he includes general surgery though the greatest stress is still laid on herniotomy and lithotomy. It is entitled "Treatise of Hernias containing a full declaration of all their varieties, and other excellent parts of surgery, that is to say the stone, the cataract of the eyes, and other diseases, of which the cure is dangerous and in which there are also few men well trained; with their causes, symptoms, complications, anatomy of the parts affected, and their complete cure."

The volume is written in early French and the style is clear and the wording concise. At times the spelling is a bit difficult but on the whole it is most interesting, especially the portion on hernia. In the anatomy, Franco pays all his attention to the hernial sac and its contents and misses entirely the influence of the muscular and aponeurotic walls of the inguinal canal on the formation of hernia. He believed that in the majority of cases of complete hernia the peritoneum ruptures while in bubonocele it is only stretched. He distinguishes between bubonocele and scrotal hernia and also recognizes the difference between enterocele and epiplocele. Likewise he shows the difference between incarcerated hernia, in which the contents are adherent to the sac, and strangulated hernia. In the former he gives detailed directions as to the dissection of the contents and in the latter he advises operation —he opens the neck of the sac from without through a high incision over the external ring. He first describes the usual operation of his time in which the testis and sac are removed *en bloc* by crushing the neck of the sac and cord and removing all material beyond the crushing clamp after which the stump is cauterized with the actual cautery. He advises the use of this procedure in cases of unilateral hernia.

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Though the treatise on hernia dominates the book, it would be unfair not to call attention to the fact that Franco was probably the first surgeon to practice suprapubic lithotomy successfully where he used it in a child after failing to remove the stone by perineal section. He also improved the operation of perineal lithotomy by devising an itinerarium and stone forceps which were much better than any in use before his time.

[1]Reviewed through the courtesy of the John Crerar Library, Chicago.

Some results of light therapy. H. C. SEMON. Practitioner, 1925, CXV, 112.

Artificial sunlight treatment. W. J. O'DONOVAN. Practitioner, 1925, CXV, 119.

Heliotherapy in the treatment of tuberculosis. H. LOGRASSO. Therap. Gaz., 1925, 3 s. xli, 539.

Experiences with ultra light rays without heat rays. E. KLEEMANN. Monatsschr. f. Geburtsh. u. Gynaek., 1925, lxviii, 268.

The practical methods of dosage of ultraviolet rays. L. HILL. Practitioner, 1925, CXV, 102.

Some observations on the dosage of ultraviolet rays in artificial sun treatment. A. EIDINOW. Lancet, 1925, ccix, 317. [493]

Action of ultraviolet light upon the growth of rats. M. E. HUME. Brit. M. J., 1925, ii, 341.

The general effect of radiation of mucous membrane with ultraviolet light. A. LAQUEUR and H. WIENER. Med. Klin., 1925, xxi, 242.

Quantitative data in tissue reactions to ultraviolet radiations. P. R. PEACOCK. Lancet, 1925, ccix, 369.

Diathermy. J. KOWARSCHIK. Berlin: Springer, 1924.

MISCELLANEOUS

Clinical Entities—General Physiological Conditions

Conditions of shock and the specificity of thermal treatment. A. LIACRE. Presse méd., Par., 1925, xxxiii, 661.

Non-specific cold abscesses. E. MELCHIOR. Beitr. z. klin. Chir., 1925, cxxxiii, 205.

A case of actinomycosis. W. ERSNER. Dental Cosmos, 1925, lxvii, 756.

Hydatid cysts. A. ROLDÁN. An. Fac. de med., Univ. de Montevideo, 1925, x, 291.

A fibrolipoma in an unusual location. P. BARCO. Ann. ital. di chir., 1923, iv, 430.

Pigmented tumors. G. CARISI. Riforma med., 1925, xli, 457.

A histological study of melanotic tumors and the effect of radiation treatment upon them. A. A. THIRAUDEAU and B. F. SCHREINER. Arch. Clin. Cancer Research, 1925, i, 29.

Precancerous conditions and the meaning of prevention in cancer. I. LEVIN. Arch. Clin. Cancer Research, 1925, i, 3.

The effect of prepuberty castration on subsequent cancer implantation. J. B. MURPHY and E. STURM. J. Exper. Med., 1925, xlii, 155.

The serum diagnosis of carcinoma. A. VON WASSERMANN. Verhandl. f. Verdauungs-u. Stoffwechselkrankh., 1925, 3.

The activation of the mesenchyma, and a contribution on the local vital staining of malignant tumors in man. W. VON GAZA. Klin. Wchnschr., 1925, iv, 745.

The etiology of malignant new growths. W. E. GYE. Lancet, 1925, ccix, 109. [495]

The microscopical examination of filterable viruses associated with malignant new growths. J. E. BARNARD. Lancet, 1925, ccix, 117. [495]

The diagnosis of carcinoma (the phosphoric acid content of the blood, Kahn's reaction, and the blood-sugar picture). F. BERNHARD. Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1924, xxxviii, 204.

The metabolism of carcinoma cells. O. WARBURG. Klin. Wchnschr., 1925, iv, 534.

The mechanism of the formation and growth of malignant tumors. A. CARREL. Ann. Surg., 1925, lxxxii, 1. [496]

The tissue reaction against growing carcinoma. VON GAZA. 49 Tag. d. deutsche. Ges. f. Chir., Berlin, 1925.

The effect of electrical currents upon epithelial and cancer cells. E. DELBANCO. Dermat. Wchnschr., 1924, lxxix, 1595.

The transplantation of distant skin flaps for the cure of intractable basal-cell carcinoma. J. S. HORSLEY. Ann. Surg., 1925, lxxxii, 14. [496]

On the radiation biology of carcinoma. OPITZ. Brit. J. Radiol., 1925, xxx, 252. [497]

Granuloma inguinale. R. R. BEST. Ann. Surg., 1925, lxxxii, 273.

Borderline sarcoma with myeloplaxes. TAVERNIER. Lyon chir., 1925, xxii, 256.

General Bacterial, Mycotic, and Protozoan Infections

Cellular immunity and its effects on the development and treatment of constitutional and infectious diseases. A. THEILHABER. Berlin: Pilger, 1925.

Hereditary tuberculosis. C. MOENCKERBERG and J. M. VERGARAK. Gynéc. et obst., 1925, xi, 331.

Heliotherapy and experimental and surgical tuberculosis. P. LEONE. Riforma med., 1925, xli, 460.

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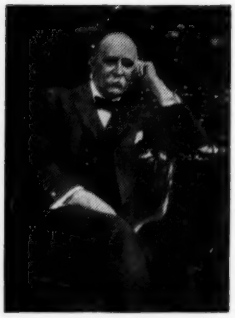
REVIEWS OF NEW BOOKS IN SURGERY



THE reaction of the reader to these interesting volumes[1] on the life of Osler will depend to a degree on his own memories of Osler, or, if he has been so fortunate, on his personal acquaintance with him. For many a reader the remembrance of a certain occasion, or address, or meeting, will bring back happy and moving recollections; and for those who were actors on the stage, Cushing's Life will be a priceless treasure. To us of a younger generation who knew Osler as a figure that loomed large in the world of medicine, but who were never so fortunate as to have seen or heard him, Cushing's Life has more than "conveyed something of his spirit," as he has suggested in his dedication; it has made Osler a vital personality that will continue through years to come to influence those who come in contact with him through the pages of these volumes.

It is not fitting to attempt here a protracted review of Osler's life. We wish rather to acknowledge our debt to the author for undertaking his arduous task and to express our admiration for the way in which he has accomplished it. He has "let his story tell itself" and has done it with the true art that conceals itself.

Cushing has produced for us an ineffaceable picture of an ideal physician, a man who was first of all a lover of his fellowmen. No one could have left so deep and permanent an impression on all with whom he came in contact unless he truly loved them. Dr. Francis suggested how fitting to him were Coleridge's lines:

> "He prayeth best who loveth best
> All things, both great and small."

Not a small part of his affection, naturally, was for those closest to him. The story of his home life is a volume in itself, and the death of his son, Revere, is touching beyond words.

Combined with this love for his fellows were the mind and outlook of the student and worker—a student who kept pace with changing developments when changes were many and rapid, a student of history, particularly of medical history, a lover and collector of books, a consistent worker who saw things largely and sanely, who strove to translate the knowledge of the scientist into practical and effective measures for improving public health. That he was a stimulating and beloved teacher and the author of a famous textbook is synonymous with the name of Osler.

We would wish for every medical student that at the beginning of his Freshman year he might read and possess Cushing's *Life of Osler*. We feel that he would not willingly part with it.

SUMNER L. KOCH.

[1] The Life of Sir William Osler. 2 vols. By Harvey Cushing, M.D. New York: Oxford University Press, 1925.

I IMAGINE there were many of us who were unable to obtain a copy of the *Manual of Surgical Anatomy* which was prepared by these authors during the late war for the Medical Corps of the Army and Navy. Certainly the Surgeon General's office must have received many urgent and pleading requests from the unfortunates. How the possessors of that manual guarded it and kept it handy. With the publication of a revised and more complete civil edition, such superiority of ownership exists no more.[2]

This hand-atlas of anatomy is in no sense a textbook, but is a portrayal of anatomy wholly by illustrations. These are concise in that they include the most practical applications of anatomy for clinical use. They are, therefore, invaluable to the surgeon and to the advanced medical student. Perhaps one of the most striking and valuable additions is that of the projection of the origins and insertions of the muscles upon the skeleton. This has always been difficult to visualize from a written text. A very complete explanatory index which works accurately and without waste of time is a feature.

Now the fortunates are less well endowed unless they put aside the old and get the new.

LOYAL DAVIS.

TUMORS of the Spinal Cord by Dr. Elsberg[3] fills a want in the literature of the surgery of spinal cord tumors as do similarly constructed monographs which deal with various types of intracranial tumors. It is the record of the considerable personal experience of the author and stands out as a worthy monument to his contributions in neurological surgery. Books written in general terms concerning the surgery of the spinal cord are useful but their necessary generalities are both confusing and misleading. It is through the setting down of well made notes which record accurate observations and the progress and termination of the case, that we are able to visualize the surgical problems which confronted the surgeon. So we may

[2] Hand-Atlas of Clinical Anatomy. By A. C. Eycleshymer, B.S., Ph.D., M.D., and Tom Jones, B.F.A. Philadelphia and New York: Lea and Febiger, 1925.

[3] Tumors of the Spinal Cord and the Symptoms of Irritation and Compression of the Spinal Cord and Nerve Roots; Pathology, Symptomatology, Diagnosis, and Treatment. By Charles A. Elsberg, M.D. New York: Paul B. Hoeber, Inc., 1925.

add our own personal discussion to the facts given and thereby we have a volume which is stimulating instead of being pleasantly hypnotic.

Dr. Elsberg has followed his study upon 81 verified spinal cord tumors by a discussion of the symptomatology produced by growths situated at the various levels, a description of the common pathological anatomy and a detailed description of the surgical procedure of laminectomy.

If this volume is read and studied carefully it cannot fail to impress the reader with the number of cases of spinal cord tumors which are seen early in their course and are diagnosed so faultily. It will have the second value of pointing out the brilliancy in the results obtained by the early removal of spinal cord tumors. LOYAL DAVIS.

THE modern surgeon is ever becoming keener in his diagnostic acumen. The basis of this acumen is a thorough understanding of living pathology and its perverted physiology. A close study of many surgical schools will demonstrate that the surgeon who depends too much upon his pathological associate for a diagnosis, lacks surgical judgment and when deprived of the services of the pathologist, faces indecision which is a potential menace to the life of his patient. This is not intended to belittle the services of the pathologist nor the aid that the well trained pathologist may render the surgeon. In arriving at a clinical diagnosis, the surgeon must know living pathology. In the operating room it is even more essential that he know pathology, since the entire operative procedure will depend upon the pathological diagnosis.

In recent years, works have appeared the purpose of which was to make available for the surgeon the study of living pathology and to omit much datum which might be interesting to the student of pathology, yet not immediately essential to the surgeon. One of the most recent of such works is the volume by Boyd.[1] The author states in his preface that he is not writing a text on "dead-house" pathology but is endeavoring to incorporate in a single volume those facts which are useful to the surgeon in detecting living pathology. He has prudently included the symptoms of certain pathological processes because in many instances clinical symptoms with certain physical findings will aid in the pathological diagnosis.

The reviewer has on numerous occasions referred to this volume during the short period of time it has been out to obtain information for surgical teaching and for help in his private work. Some criticism might be offered in that certain subjects such as gastric and duodenal ulcer and benign tumors of the breast are too briefly treated, yet "brevity is the soul of wit."

This work treats of pathology only as related to surgical diseases and of necessity omits all purely medical conditions such as diseases of the heart and lungs. The text is well written and many origina illustrations are incorporated. The book contains much information in readily available form and is exceedingly valuable to the student of surgery.

J. A. WOLFER.

THE recent monograph by Beck[2] calls to our attention the importance of the human hand. No doubt all the organs of precision are invaluable to the functioning whole, yet the hand which is constantly in use, which is continuously subjected to trauma and which, as in the machinist, is kept from harm solely by a well trained nervous mechanism, is the most frequent seat of injury and infection and when deformed, the resultant disability becomes a handicap which seriously menaces the working capacity of the average artisan, be he a plumber or a surgeon.

The author displays imagination in his plastic work. The congenital deformities are well treated, practically all of these are mentioned and their treatment illustrated and described. Pedicle flaps from the chest and abdominal wall are resorted to frequently. There is brevity and lack of fullness in the presentation of the anatomical and surgical aspect of the subject of infections of the hand as a cause of deformity. Curiosity is aroused for more information on the subject of tendon loss in the hand, since this is a common deformity difficult to treat. It would seem to the reviewer that if the subject of infections and their treatment is considered, it should be treated more thoroughly. There is no question but that here prophylaxis plays a greater rôle than plastic surgery.

The author has covered much of the subject in a very commendable manner; but this type of surgery is still in its infancy and it is to be hoped that the author will enlarge upon the subject as his experience advances. J. A. WOLFER.

A BRIEF manual of X-ray technique and interpretation for the student of medicine is most desirable. The student has neither the time nor the patience to read the numerous journals or the more exhaustive works on roentgenology, consequently he should have available a brief work which he can consult. The reviewer knows of no work more concise and clear than the recent volume by Christie.[3] This work is not meant for the roentgenologist or the specialist in medicine but is written essentially for the student. The first portion of the volume is devoted to the general principles of electricity and magnetism, the roentgen-ray and tube, apparatus, and the like. Roentgenographic and dark room technique are briefly yet clearly described. Following this the author discusses the roentgenographic study of the various systems or regions of the body and their demonstratable pathology. Two

[1] Surgical Pathology. By William Boyd, M.D., M.R.C.P. (Ed.), F.R.S.C. Philadelphia and London: W. B. Saunders Company, 1925.

[2] The Crippled Hand and Arm. By Carl Beck, M.D. Philadelphia and London: J. B. Lippincott Company, 1925.

[3] Roentgen Diagnosis and Therapy. By Arthur C. Christie, M.D., M.S., F.A.C.P. Philadelphia, London, Montreal: J. B. Lippincott Company, 1924.

short chapters are given to roentgenotherapy. The text is exceedingly well illustrated. It would seem that this work should be heartily welcomed by the teacher of roentgenology and by the student of medicine. J. A. WOLFER.

IN a recent review, attention was called to the importance of infections of the hand and their treatment. There is probably no other surgical condition so frequently encountered nor one which has greater surgical and economic significance than infections of the hand. A trivial injury may lead to the loss of a finger, the disability of a hand, or through general sepsis even to loss of life. To avoid such a catastrophe, early and exact diagnosis must be made and correct treatment promptly instituted.

By far the largest number of infections of the hand are seen by the general practitioner who unfortunately is not always sufficiently skilled to treat these cases properly. It is not only the general practitioner who needs assistance. Many surgeons display woeful ignorance of the subject. A survey of the literature indicates little excuse for such lack of knowledge. The fifth edition of Kanavel's[1] work has just been placed before the profession. The reviewer has followed this work from the first edition down to the present and has observed the effect it has had on the conduct of the medical profession. There is no question but that hand infections are treated much more skillfully now than they were 15 years ago; yet, the average surgeon has much to learn.

This monograph has always held an enviable position in American surgical literature. The clarity with which the author presents the subject, the infinite ability to co-ordinate experimental and clinical data into a practical treatise, the use of carefully selected illustrations and case histories, all tend toward the production of a real masterpiece. The author has incorporated much new material in this edition, especially on the prevention and correction of deformities. In the preface he states: "In the treatment of infections of the hand, the surgeon should never forget that the technical procedures incident to instituting drainage, though important, are only the first step in the treatment. If he is to secure the best results, he must not only control the infection, he must also preserve the function of the hand." This phase has received especial attention in the new edition. The author describes in detail the position in which the parts should be placed to facilitate drainage and muscle rest and to insure maximum function in case of extensive loss of tissue. Plastic surgery of the hand is described in a most interesting and lucid manner.

In each edition of this work, the author has added materially to the subject, which is one of the most important in the domain of surgery. This monograph is a classic in medical literature and is indispensable to the physician or surgeon whose duties encompass this field. J. A. WOLFER.

THE ninth edition of *Modern Surgery* by DaCosta[2] has just come before the reviewer. It is very pleasing to note that much of the obsolete material has been replaced by modern surgical conceptions. The arrangement of the text remains practically unchanged. The chapter on bacteriology has been prudently omitted from the new edition. It has always been the reviewer's opinion that such subjects as bacteriology, technique of sterilization, asepsis, and allied topics, have no place in a textbook of surgery. For such subjects to be efficiently presented, considerable space must be allotted—in fact much more space than is available in a single volume textbook of surgery.

A survey of this edition would indicate that much penciling has been done and much new data incorporated. With few exceptions the contents are thoroughly revised to date. Certain criticisms may be offered. The subject of fractures is presented in a too brief and dogmatic manner in comparison with the presentation of other subjects. More attention could be devoted to tenosynovitis and infections of the hand. Bronchoscopy is most elaborately discussed. This again is not in keeping with a text on general surgery. Bronchoscopy is a highly specialized art. There is no question but that the student of surgery should know the range of possibilities of bronchoscopy, yet the technique of this procedure should be left to the monograph—such as the admirable one from Jackson, a few years ago.

These suggestions are of minor importance when the work as a whole is considered. The present revision places DaCosta's book where it rightfully belongs—in the lead of American textbooks of surgery. J. A. WOLFER.

[1] Infections of the Hand; a Guide to the Surgical Treatment of Acute and Chronic Suppurative Processes in the Fingers, Hand, and Forearm. By Allen B. Kanavel, M.D. Philadelphia and New York: Lea and Febiger, 1925.

[2] Modern Surgery; General and Operative. By John Chalmers DaCosta, M.D., LL.D., F.A.C.S. 9th ed. Philadelphia and London: W. B. Saunders Company, 1925.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

SYMPTOMS OF VISCERAL DISEASE; a Study of the Vegetative Nervous System in its Relationship to Clinical Medicine. By Francis Marion Pottenger, A.M., M.D., LL.D., F.A.C.P. 3d ed. St. Louis: The C. V. Mosby Co., 1925.

SOME FUNDAMENTAL CONSIDERATIONS IN THE TREATMENT OF EMPYEMA THORACIS. By Evarts A. Graham, A.B., M.D. St. Louis: The C. V. Mosby Co., 1925.

DIE KLINIK DER BOESARTIGEN GESCHWUELSTE. Edited by Geh. Rat. Prof. Dr. P. Zweifel and Geh. Med.-Rat. Prof. Dr. E. Payr. vol. ii. Leipzig: S. Hirzel, 1925.

TRAITEMENT DU DIABÈTE. By Pedor Escudero. Paris: A. Maloine & Fils, 1925.

THE ICONOGRAPHY OF ANDREAS VESALIUS (ANDRÉ VÉSALE), 1514–1564. By M. H. Spielmann, F.S.A. London: John Bale, Sons & Danielsson, Ltd., 1925.

A MANUAL OF GYNECOLOGY. By John Cooke Hirst, M.D., F.A.C.S. Philadelphia and London: W. B. Saunders Company, 1925.

DIAGNOSTIK MIT FREIEM AUGE (EKTOSKOPIE). By Dr. Eduard Weisz. Berlin and Vienna: Urban & Schwarzenberg, 1925.

BIOLOGIE UND PATHOLOGIE DES WEIBES; ein Handbuch der Frauenheilkunde und Geburtshilfe. Edited by Josef Halban and Ludwig Seitz. Lieferungen 15, 16, and 17. Berlin and Vienna: Urban & Schwarzenberg, 1925.

THE SURGERY OF PULMONARY TUBERCULOSIS. By John Alexander, B.S., M.A., M.D. Philadelphia and New York, Lea & Febiger, 1925.

DIE FRUCHTABTREIBUNG ALS VOLKSKRANKHEIT; GEFAHREN, URSACHEN, BEDAEMPFUNG; im Auftrag des deutschen Aerztevereinsbundes. By San-Rat Dr. Vollmann. Leipzig: George Thieme, 1925.

THE OPHTHALMIC YEAR BOOK. vol. xxi. Edited by William H. Crisp. Chicago: Ophthalmic Publishing Company, 1925.

CANCRO DO ÚTERO; Apontamentos para o Estudo e Regimento da sua Profilaxia. By Jorge Monjardino. Rio de Janeiro: Pimenta de Mello & C., 1925.

TEXTBOOK OF ORTHOPEDIC SURGERY; for Students of Medicine. By James Warren Sever, M.D. New York: The Macmillan Company, 1925.

SURGICAL TREATMENT OF PULMONARY AND PLEURAL TUBERCULOSIS. By J. Gravesen, M.D., with a foreword by S. Vere Pearson, M.D., M.R.C.P. New York: William Wood & Co., 1925.

CANCER—Post Graduate Lectures, Delivered under the Auspices of the Fellowship of Medicine. Edited by Herbert J. Paterson, with a preface by Sir John Bland-Sutton, LL.D., F.R.C.S. New York: William Wood & Co., 1925.

MODERN OPERATIVE SURGERY. Edited by H. W. Carson, F.R.C.S. (Eng.). vols. i and ii. New York: William Wood & Company, 1925.

ALLERGY. Asthma, Hay Fever, Urticaria and Allied Manifestations of Reaction. By William W. Duke, Ph.B., M.D. St. Louis: C. V. Mosby Co., 1925.

OPERATORIA UROLÓGICA. By Dr. Manuel Serés. Barcelona: Juan B. Aragonés, 1925.

ACTAS Y TRABAJOS. TRANSACTIONS OF THE SECOND NATIONAL CONGRESS OF MEDICINE, ARGENTINA. vol. i—inaugural session, Hydatidosis. Buenos Aires: E. Spinelli, 1923.

GYNECOLOGIC UROLOGY. By Lynn Lyle Fulkerson, A.B., M.D., F.A.C.S. Philadelphia: P. Blakiston's Sons & Co., 1925.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

CHARLES H. MAYO, Rochester, *President* RUDOLPH MATAS, New Orleans, *President-Elect*
FRANKLIN H. MARTIN, Chicago, *Director-General*

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PROGRAM FOR THE CLINICAL CONGRESS IN PHILADELPHIA

THE fifteenth annual Clinical Congress of the American College of Surgeons will open at 10 o'clock on Monday morning, October 26 at the Bellevue-Stratford Hotel in Philadelphia with the annual hospital conference. At the presidential meeting on Monday evening, the first formal session of the Congress, the President-Elect, Dr. Rudolph Matas of New Orleans, will be inaugurated, succeeding Dr. Charles H. Mayo in that office. The John B. Murphy oration in surgery will be delivered at that session by Sir William Arbuthnot Lane of London, England.

Clinics and demonstrations at the hospitals and medical schools will provide an interesting program for the mornings and afternoons of the four days, Tuesday to Friday, inclusive, with scientific sessions each evening. For these evening sessions the Executive Committee of the Congress has provided programs of unusual interest. A complete program for the evening sessions will be found in the following pages. At the convocation of the College on Friday evening the Fellowship Address will be given by Lord Dawson of London, England, physician to King George.

The Committee on Arrangements, of which Dr. Charles F. Nassau is Chairman and Dr. Warren B. Davis Secretary, has prepared a program of clinics and demonstrations that will surpass in scientific interest all previous sessions. The preliminary clinical program is being reprinted in this issue. This program will be revised and amplified previous to the meeting, so that the actual program will fully represent the clinical activities in all departments of surgery. The real program of the Congress is to be issued daily during the session giving in complete detail a description of the clinics and demonstrations at the several hospitals and medical schools. This program will be issued in the form of bulletins posted each afternoon at headquarters for the following day's clinics. A printed program will be issued each morning.

An important feature of the program will be a series of clinical demonstrations or "dry

clinics" at a number of the hospitals in which surgeons, internists, pathologists, roentgenologists, and other specialists will participate to discuss some of the more important phases of surgery.

Of special interest to those engaged in the practice of ophthalmology and otolaryngology is the program of papers and demonstrations prepared by the Committee to be given in the Ballroom on Wednesday, Thursday, and Friday mornings at nine o'clock supplementing the clinical work in the hospitals in the afternoon.

General headquarters of the Congress will be established at the Bellevue-Stratford Hotel, Broad and Walnut streets, where the entire first floor, including the Ballroom, Clover, Red, Pink, and Gold rooms, together with the Stratford Room on the main floor and the Rose Garden and other rooms on the roof, have been reserved for the exclusive use of the Congress. These rooms provide ample space for evening meetings, business sessions, hospital standardization headquarters, registration and ticket bureaus, bulletin rooms, etc. Headquarters will be open for registration at eight o'clock on Monday, October 26.

The clinical program for Tuesday will be posted on bulletin boards at headquarters during Monday afternoon and reservations for tickets for Tuesday's clinics may be filed late that afternoon.

The annual meeting of the Fellows of the College will be held in the Ballroom of the Bellevue-Stratford on Thursday afternoon at three o'clock to be followed by the annual meeting of the Board of Governors.

Since the last session of the Congress in Philadelphia in 1921 there have been erected in that city a number of fine, large hotels situated within easy walking distance of the Bellevue-Stratford, so that the hotel situation in that city has been greatly improved. A list of the Philadelphia hotels recommended by the Local Committee on Arrangements, together with the rates, will be found on another page.

HOSPITAL CONFERENCE

The preliminary program for the annual hospital conference to be held on Monday, Tuesday, and Wednesday, both mornings and afternoons, at the Bellevue-Stratford will be found in the pages following. Addresses, demonstrations, round table conferences, and general discussions by surgeons, superintendents, trustees, nurses, and others interested in the conduct of hospitals deal intimately with the details of hospital standardization and management, providing a program of very great interest and practical value in treating many of the everyday problems and difficulties encountered in hospital management and the care of the patient within the hospital.

At the opening session on Monday morning, Dr. Franklin H. Martin, Director-General, will present his report including a list of the hospitals which appear on the approved list for the year 1925.

A hospital information and service bureau, in charge of Dr. M. T. MacEachern, Associate Director in charge of hospital standardization activities, will be maintained in the Congress headquarters throughout the session to give assistance to any hospital seeking solutions of its troublesome problems. All who are particularly interested in hospital problems are requested to register at hospital standardization headquarters upon arrival at Philadelphia. A general invitation is extended to hospital trustees, members of the medical and surgical staffs, and hospital personnel generally to attend the conference.

REDUCED RAILWAY FARES

The railways of the United States and Canada have authorized reduced fares on account of the Philadelphia session of the Clinical Congress, so that the total fare for the round trip will be one and one-half the ordinary first-class one-way fare. To take advantage of the reduced rates it is necessary to pay the full one-way fare to Philadelphia, procuring from the ticket agent a "convention certificate" when purchasing such ticket, which certificate is to be deposited at headquarters for the visé of the special agent of the railway companies. Upon presentation of viséed certificate to the ticket agent in Philadelphia not later than November 3 a ticket for the return journey by the same route as traveled to Philadelphia may be purchased at one-half the regular one-way fare.

In the eastern, central, and southern states and eastern provinces of Canada tickets may be purchased between October 22 and 28; in southwestern and western states between October 21 and 27 and in the far western states and western provinces of Canada between October 16 and 22. The return journey from Philadelphia must be begun not later than November 3.

The reduction in fares does not apply to Pullman fares, nor to excess fares charged for passage on certain trains. Local railroad ticket agents will supply detailed information with regard to rates, routes, etc. Stop-overs on both the going and return journeys may be had within certain limits.

Full fare must be paid from starting point to Philadelphia, and it is essential that a "convention certificate" be obtained from the agent from whom the ticket is purchased. These certificates are to be signed by the general manager of the Clinical Congress and viséed by a special agent of the railroads in Philadelphia during the meeting. No reduction in railroad fares can be secured except in compliance with the regulations outlined and within the dates specified. It is important to note that the return trip must be made by the same route as used to Philadelphia and that the certificate must be presented and return ticket purchased not later than November 3.

SPECIAL TRAIN FROM CHICAGO

For the convenience of Fellows residing in the central and western states who will attend the meeting in Philadelphia, the Pennsylvania Railroad will undertake to provide a special train leaving Chicago at 1:15 p.m. on Sunday, October 25, arriving in Philadelphia at 9 a.m. on Monday, October 26. This special train will duplicate the equipment and schedule of the famous Broadway Limited including standard Pullman sleeping, compartment, club, observation, and dining cars. The arrangement is contingent upon reservations for such special train being made by the minimum number required by the Interstate Commerce Commission rules. No extra fare will be charged for passage on this special train. Members are urged to make their reservations for the special train at the earliest possible date.

LIMITED ATTENDANCE

Attendance at the Philadelphia session will be limited to a number that can be comfortably accommodated at the clinics, the limit of attendance being based upon the result of a survey of the amphitheaters, operating rooms, and laboratories in the hospitals and medical schools as to their capacity for accommodating visitors. This plan necessitates registration in advance on the part of all who wish to attend. When the limit of attendance has been reached through advance registration, no further applications can be accepted.

CLINIC TICKETS

Attendance at clinics and demonstrations will be controlled by means of special clinic tickets, which plan has proved an efficient means in the past for providing for the distribution of visiting surgeons among the several clinics and insures against overcrowding, as the number of tickets issued for any clinic is limited to the capacity of the room in which that clinic is given.

Clinic tickets will be issued at headquarters each morning at eight o'clock for the clinics and demonstrations to be given that day. Each afternoon a complete schedule of the following day's clinics will be posted on bulletin boards at headquarters. After the program has been posted, reservations for clinic tickets may be filed, the tickets to be issued the following morning.

REGISTRATION FEE

A registration fee of $5.00 is required of each surgeon attending the annual clinical meeting, such fees providing the funds with which to meet the expenses of the meeting. To each surgeon registering in advance, a formal receipt for the registration fee is issued, which receipt is to be exchanged for a general admission card upon his registration at headquarters during the meeting. This card, which is nontransferable, must be presented to secure clinic tickets and admission to the evening meetings.

PHILADELPHIA HOTELS AND THEIR RATES

	Minimum Rate for Room with Bath	
	Single	Double
Adelphia, Chestnut and 13th Sts.	$4.00	$8.00
Bellevue-Stratford, Broad and Walnut Sts.	5.00	8.00
Benjamin Franklin, Chestnut and 9th Sts.	3.00	6.00
Green's, 8th and Chestnut Sts.	3.50	5.00
Longacre, Walnut St. West of Broad	4.00	6.00
Lorraine, Broad St. and Fairmont Ave.	2.50	5.00
Majestic, Broad St. and Girard Ave.	4.00	5.00
Robert Morris, 17th and Arch Sts.	3.00	5.00
Pennsylvania, Chestnut and 39th Sts.	3.00	6.00
Rittenhouse, Chestnut and 22nd Sts.	3.50	5.00
Ritz-Carlton, Broad and Walnut Sts.	6.00	10.00
Spruce (men only), Spruce and 13th Sts.	4.00	.....
St. James, Walnut and 13th Sts.	3.50	5.00
Stenton, Broad and Spruce Sts.	5.00	7.00
Sylvania, Locust and Juniper Sts.	4.00	6.00
Walton, Broad and Locust Sts.	3.00	5.00

PROGRAM FOR EVENING MEETINGS

IN THE BALLROOM OF THE BELLEVUE-STRATFORD AT 8 O'CLOCK

Presidential Meeting—Monday, October 26

Address of Welcome: CHARLES F. NASSAU, M.D., Chairman of Committee on Arrangements.

Address of Retiring President: The Function of the Liver. CHARLES H. MAYO, M.D., Rochester.

Introduction of Foreign Guests.

Inaugural Address: Personal Experience in the Surgical Cure of Aneurism (illustrated by motion pictures). RUDOLPH MATAS, M.D., New Orleans.

The Doctor John B. Murphy Oration in Surgery: A Tribute to Doctor Murphy. SIR WILLIAM ARBUTHNOT LANE, Bt., London, England.

Tuesday, October 27

CHEVALIER JACKSON, M.D., Philadelphia: Pulmonary Suppuration Due to Foreign Body Contrasted with that of Other Etiology. (Chalk and lantern demonstration.)

VICTOR PAUCHET, M.D., Paris, France: Experiences in the Surgical Treatment of Gastric, Duodenal and Jejunal Ulcers.

Discussion: JOHN H. GIBBON, M.D., Philadelphia.

A. MURAT WILLIS, M.D., Richmond, Virginia: The Mortality in Important Surgical Diseases, Especially Appendicitis.

Discussion: DAMON B. PFEIFFER, M.D., and JOHN STEWART RODMAN, M.D., Philadelphia.

PROFESSOR VITTORIO PUTTI, Bologna, Italy: Congenital Dislocation of the Hip.

Discussion: ARTHUR BRUCE GILL, M.D., and DEFOREST WILLARD, M.D., Philadephia.

Wednesday, October 28

ARTHUR H. CURTIS, M.D., Chicago: Chronic Pelvic Infections; Deductions Resultant from a Combined Clinical and Laboratory Study.

Discussion: CHARLES C. NORRIS, M.D., and P. BROOKE BLAND, M.D., Philadelphia.

W. BLAIR BELL, B.S., M.D., Liverpool, England: The Treatment of Chronic Ascending Infections of the Uterus and Adnexa by the Bell-Beuttner Operation with Ovarian Conservation or Grafting.

Discussion: JOHN G. CLARK, M.D., and BROOKE M. ANSPACH, M.D., Philadelphia.

ROBERT C. COFFEY, M.D., Portland, Oregon: The Principles of the Radical Treatment of Cancer of the Organs Located in the Pelvis.

Discussion: JOHN B. DEAVER, M.D., Philadelphia.

Thursday, October 29

Symposium on the Rehabilitation of the Handicapped Surgical Patient:

Patients Suffering from Lesions of the Stomach and Duodenum: GEORGE B. EUSTERMAN, M.D., and DONALD C. BALFOUR, M.D., Rochester, Minnesota.

Patients Suffering from Goiter: ROBERT S. DINSMORE, M.D., Cleveland.

Cardiorenal Cases: FRANK H. LAHEY, M.D., Boston.

Patients Suffering from Urinary Obstruction: HERMON C. BUMPUS, M.D., VERNE C. HUNT, M.D., and WALTMAN WALTERS, M.D., Rochester, Minnesota.

The Use of Insulin in Surgery and Obstetrics: F. N. G. STARR, M.D., Toronto, Ontario.

Discussion: FREDERICK G. BANTING, M.D., Toronto, Ontario.

General Discussion: GEORGE P. MULLER, M.D., and JOHN H. JOPSON, M.D., Philadelphia.

Convocation—Friday, October, 30

Invocation.

Conferring of Honorary Fellowships.

Presentation of Candidates for Fellowship.

Presidential Address: RUDOLPH MATAS, M.D., New Orleans.

Fellowship Address: THE RIGHT HON. LORD DAWSON OF PENN., G.C.V.O., K.C.M.G., C.B., M.D., London, England, Physician in Ordinary to H. M. the King.

HOSPITAL STANDARDIZATION CONFERENCE

IN THE BALLROOM OF THE BELLEVUE-STRATFORD

Monday, October 26—Morning Session, 10:00 to 12:30

CHARLES H. MAYO, M.D., Rochester, President, Presiding

Opening Address by the President.

Presentation of the Eighth Annual Report of Hospital Standardization. FRANKLIN H. MARTIN, M.D., Chicago; Director-General, American College of Surgeons.

The Responsibility of the Fellows of the American College of Surgeons in Hospital Standardization. LEROY LONG, M.D., Oklahoma City, Okla.; Dean and Professor of Surgery, University of Oklahoma School of Medicine.

The Hospital, the Doctor, and the Nurse as Co-operating Factors in the Care of the Patient. W. T. HENDERSON, M.D., Mobile, Ala.; Visiting Surgeon, Providence Infirmary and Mobile City Hospital.

The Eminent Hospital. REV. C. B. MOULINIER, S.J., Milwaukee; President, Catholic Hospital Association.

What the American College of Surgeons Can Do for the Smaller Hospital. PAUL H. FESLER, Oklahoma City, Okla.; Superintendent, State University Hospital.

Hospital Efficiency from the Viewpoint of the Internist. ALFRED T. STENGEL, M.D., Philadelphia; Professor of Medicine, University of Pennsylvania; President, American College of Physicians.

Political Interference in Hospitals. RUDOLPH MATAS, M.D., New Orleans; Professor of Surgery, Tulane University of Louisiana School of Medicine; President-Elect, American College of Surgeons.

Afternoon Session, 2:00 to 5:00

The Hospital of the Future. NEWTON E. DAVIS, Chicago; President, American Protestant Hospital Association; Corresponding Secretary, Board of Hospitals, Homes and Deaconess Work of the Methodist Episcopal Church.

The Application of American College of Surgeons Standards in the Modern Hospital. H. L. FOSS, M.D., Danville, Pa.; Surgeon-in-Chief, Geisinger Memorial Hospital.

Essentials for an Efficient Fracture Service in a Hospital. CHARLES L. SCUDDER, M.D., Boston; Consulting Surgeon, Massachusetts General Hospital.

End-Results and Follow-Up. HENRY L. PAGE, M.D., Philadelphia; Medical Director, Lankenau Hospital; and MISS ANNIE M. JASTROW, Philadelphia; Record Librarian, Lankenau Hospital.

Postmortems in Hospitals

Findings in the State of Pennsylvania Survey. FRANK C. HAMMOND, M.D., Philadelphia; Dean and Professor of Gynecology, Temple University Department of Medicine.

Relation of the Surgeon to Postmortems. CHARLES BAGLEY, JR., M.D., Baltimore; Associate in Experimental Neurology, Johns Hopkins University Medical Department.

Postmortems in the Open Hospital. ISRAEL BROWN, M.D., Norfolk, Va.; Surgeon, St. Vincent's Hospital and Sanitarium.

General discussion.

Tuesday, October 27—Morning Session, 10:00 to 12:30

Group Conference on Medical Service in Hospitals—Ophthalmology and Otolaryngology. JAMES A. BABBITT, M.D., Philadelphia, Associate Professor of Otolaryngology, University of Pennsylvania Graduate School of Medicine, presiding. Topics for discussion: Minimum requirements for ophthalmological and otolaryngological departments in general hospitals. Need for ophthalmological and otolaryngological departments in general hospitals in a community where there is no special hospital for the purpose. Special physical features to be considered in planning the department; accommodations

for patients, rooms, wards, etc.; examination, treatment, and operating rooms. Standardization of equipment, supplies, and procedures. Organization of the department, relation to general organization, medical and nursing. Relation to allied services—clinical laboratory, X-ray, anæsthesia; requisitioning for clinical laboratory and X-ray service; routine clinical laboratory, pre-anæsthesia and pre-operative examination; special X-ray technique required. Case recording, forms used, content of records, filing of records, supervising of records, filing and cross indexing of records, use of records.

General discussion.

Afternoon Session, 2:00 to 5:00

The Rôle of the Medical Staff in Hospital Efficiency. J. GARLAND SHERRILL, M.D., Louisville; Professor of Surgery, University of Louisville Medical Department.

Round Table Conference. Conducted by JOSEPH C. DOANE, M.D., Philadelphia, Medical Director and Superintendent, Philadelphia General Hospital. Topics for discussion: The relation and responsibility of the hospital administration in pre-operative preparatory procedures; the relations and responsibilities of the interne; the best methods of making more efficient the instruction and experience of the internes and nurses in the surgical department; responsibility of the surgeon in promoting economies in the surgical department; the most efficient arrangement of concurrent staff services in relation to duty; the essentials for an efficient anæsthesia department; supervision and control of the surgical department; the "open hospital" policy; the best means for handling extra charges for special services; the education of new trustees in regard to the hospital and its workings.

General discussion.

Wednesday, October 28—Morning Session, 10:00 to 12:30

Group Conference on Medical Service in Hospitals—Internal Medicine. ALFRED T. STENGEL, M.D., Philadelphia, Professor of Medicine in University of Pennsylvania, President of American College of Physicians, presiding.

Afternoon Session—2:00 to 5:00

Systematic Collection and Official Publication of Operative Mortalities as a Means of Fostering Surgical Accountancy. ROBERT L. DICKINSON, M.D., New York, Senior Gynecologist and Obstetrician to Brooklyn Hospital.

Round Table Conference. Conducted by JOHN D. SPELMAN, M.D., New Orleans, Superintendent of Touro Infirmary. Topics for discussion: A plan of procedure in selecting members of the medical staff and extending privileges to doctors to practice therein; the ownership of the case record; the best means of improving the quality of case records; the relation of medical staff to board of trustees; the hospital and the private duty nurse; the relative advantages and disadvantages of continuous versus divided ward services in a hospital; dental service in hospitals; isolation, segregation, and observation accommodations in all hospitals; the problem of the tuberculous patient in the general hospital; physiotherapy in hospitals.

General discussion.

GENERAL SURGERY, GYNECOLOGY, OBSTETRICS ORTHOPEDICS, UROLOGY

PRESBYTERIAN HOSPITAL

Tuesday

JOHN H. JOPSON and DAMON B. PFEIFFER—9. General surgery.
FRANK C. KNOWLES and HENRY G. MUNSON—1. Dermatological clinic.
JOHN H. GIRVIN, GEORGE M. LAWS and PHILIP F. WILLIAMS—1:30. Gynecological clinic; pathological exhibit and demonstration of routine work in gynecological dispensary.
W. S. NEWCOMET—2:30. Roentgenology.

Wednesday

J. STEWART RODMAN and HENRY P. BROWN—9. General surgery.
B. A. THOMAS and F. G. HARRISON—2. Demonstration of conduct and equipment of genito-urinary dispensary.
W. S. NEWCOMET—2:30. Roentgenology.
B. A. THOMAS, JOSEPH C. BIRDSALL and F. G. HARRISON—3. Genito-urinary clinic.

Thursday

JOHN SPEESE and W. E. CHRISTIE—9. General surgery.
JOHN EIMAN and W. E. CHRISTIE—2. Demonstration in surgical pathology.
W. S. NEWCOMET—2:30. Roentgenology.

Friday

JOHN H. JOPSON and DAMON B. PFEIFFER—9. General surgery.
W. S. NEWCOMET—2:30. Roentgenology.

HOWARD HOSPITAL

Tuesday

E. L. ELIASON, DRURY HINTON and V. W. M. WRIGHT—10. General surgical clinic; industrial surgery, outline of record system, follow-up; routine surgery.

Wednesday

B. C. HIRST—9. Gynecological clinic.

Thursday

E. L. ELIASON, DRURY HINTON and V. W. M: WRIGHT—10. Fracture clinic, methods and results; routine surgery under local anæsthesia.
S. W. MOORHEAD—4. Genito-urinary clinic, demonstration of use of local anæsthesia in urology.

Friday

B. C. HIRST—9. Gynecological clinic.

FRANKFORD HOSPITAL

Wednesday

W. E. PARKE—9:30. Plastics, plastic and retroversion of uterus.
E. A. SCHUMANN—9:30. Fibroid of uterus, carcinoma of uterus, plastic and section.
G. C. HANNA—9:30. Cæsarian section.
F. E. KELLER—9:30. Cæsarian section, local anæsthesia.

Thursday

CHARLES F. NASSAU—9:30. Cholelithiasis, duodenal ulcer, nephrolithiasis, goiter.
LOUIS D. ENGLERTH—9:30. Hernia under local anæsthesia, fracture clinic.

PENNSYLVANIA HOSPITAL

Tuesday

HENRY B. BROWN and EDWARD STRECKER—9. Dry clinic: The surgical and neurological aspects of fracture of the skull.
GEORGE NORRIS and staff—10. Medical aspects and diagnosis of the cases to be operated upon.
CHARLES F. MITCHELL, WALTER ESTELL LEE, and HENRY B. BROWN—11. General surgical operations.

Wednesday

LEON HERMAN—9. Dry clinic: Genito-urinary cases.
GEORGE NORRIS and staff—10. Medical aspects and diagnosis of cases to be operated upon.
JOHN H. GIBBON, ARTHUR E. BILLINGS, and EDWARD J. KLOPP—11. General surgical operations.

Thursday

JAMES CAMERON—9. Dry clinic: Oral surgical cases.
Staff—10. Demonstration of the surgical pathology of tissues removed at operation in the surgical clinics on the two previous days.
EDWARD F. DILLON—11. Care of diabetics before and after surgical procedure.
W. D. STROUD—12. Heart disease in relation to surgical operation.
CHARLES F. MITCHELL, WALTER ESTELL LEE, and HENRY B. BROWN—1. General surgical clinic.

EPISCOPAL HOSPITAL

Tuesday

RALPH S. BROMER—9. X-ray demonstration.
LOUIS H. MUTSCHLER—11. General surgery.

Wednesday

ASTLEY P. C. ASHHURST, IRVINE M. BOYKIN, and EDWARD T. CROSSAN—9. General surgery.
A. BRUCE GILL, R. L. JOHN, and A. F. MOXEY—2. Orthopedics.

Thursday

E. G. ALEXANDER—9. General surgery.
H. C. DEAVER—11. General surgery.

Friday

E. T. CROSSAN—9. Demonstration in surgical pathology.
L. H. MUTSCHLER—11. General surgery.
JOHN B. HAINES—2. Cystoscopic clinic.

POLYCLINIC HOSPITAL

Tuesday

DEFOREST P. WILLARD—10:30. Orthopedics.
G. E. PFAHLER—2. Radiologic conference.
B. A. THOMAS—2. Urology.

Wednesday

W. G. ELMER—11:30. Orthopedics.

Thursday

COLLIER F. MARTIN—1. Proctology.
J. F. SCHAMBERG—2. Arsphenamin clinic.

Friday

R. H. IVY—9. Plastic surgery of the face.
B. A. THOMAS—2. Urology.
E. A. CASE—2. Surgical pathology.

JEFFERSON HOSPITAL

Tuesday

J. TORRANCE RUGH—9:30. Orthopedics.
CHARLES F. NASSAU—11. General surgery.
THOMAS C. STELLWAGEN—11. Genito-urinary surgery.
JOHN H. GIBBON—2. General surgery.

Wednesday

CHEVALIER JACKSON—9. Bronchoscopy for diagnosis and treatment of diseases of the lungs.
BROOKE M. ANSPACH and staff—9. Gynecology.
P. BROOKE BLAND—9. Gynecology.
W. H. KINNEY—11. Genito-urinary surgery.
JOHN B. FLICK—11. General surgery.
J. CHALMERS DACOSTA—2. Surgical clinic.

Thursday

H. R. LOUX—9. Genito-urinary surgery.
J. M. FISHER—11. Gynecology.
THOMAS A. SHALLOW—11. General surgery.
ARTHUR DAVIDSON—11. Orthopedic surgery.
CHEVALIER JACKSON, GABRIEL TUCKER, and LOUIS CLERF—12:30. Bronchoscopic aspiration in suppurative diseases of the lung.

Friday

EDWARD J. KLOPP—11. General surgery.

ST. MARY'S HOSPITAL

Tuesday

JAMES A. KELLY—9. General surgery.
WILLIAM J. RYAN—9. General surgery.
WILBUR H. HAINES and L. F. MILLIKEN—2. Genito-urinary clinic.
W. T. REES. Laboratory demonstration.

Wednesday

WILLIAM A. STEEL—9. Abdominal surgery with spinal anæsthesia.
A. P. KEEGAN—9. General surgery and local anæsthesia.
C. HOWARD MOORE—2. Orthopedic clinic, operations and demonstration of cases.
W. T. REES. Laboratory demonstration.

Thursday

FRANK D. HARRIS—9. Gynecology.
WILLIAM F. MORRISON—9. Gynecology.
WILLIAM E. PARKE and J. STUART LAWRENCE—12:30. Obstetrical clinic, labor room and ward walks. Operations. Prenatal clinic.
W. T. REES. Laboratory demonstration.

SAMARITAN HOSPITAL

Tuesday

JOHN LEEDOM, J. O. BOWER, G. MASON ASTLEY, JOHN C. FRICK, and J. N. COOMBS—9. Surgical clinic.
HARRY HUDSON—2. Orthopedic clinic.
ALBERT STRICKLER—3. Dermatology.

Wednesday

W. WAYNE BABCOCK—9. General surgery.
CHARLES S. BARNES and C. M. STIMSON—11. Obstetrics.
FRANK C. HAMMOND—2. Gynecology.
W. HERSHEY THOMAS—4. Genito-urinary surgery.
HARRY Z. HIBSHMAN—5. Rectal clinic.

Thursday

A. C. APPLEGATE—11. Obstetrics.

Friday

W. WAYNE BABCOCK—9. General surgery.

MISERICORDIA HOSPITAL

Tuesday

BASIL BELTRAN and staff—9. General surgery.
JAMES A. KELLY and staff—9. General surgery.

Wednesday

GEORGE P. MULLER and THOMAS RYAN—9. General surgery.
J. F. X. JONES, A. E. BURKE, and J. J. CANCELMO—12. General surgical clinic; Buerger's disease; a case of tetanus; osteomyelitis following a compound fracture of the pubic bone.

Thursday

BASIL BELTRAN and staff—9. General surgery.
JAMES A. KELLY and staff—9. General surgery.

Friday

GEORGE P. MULLER and THOMAS RYAN—9. General surgery.
J. F. S. JONES, A. E. BURKE, and J. J. CANCELMO—12. General surgical clinic; acute osteomyelitis of tibia; repair of perineal laceration; hernioplasty with local anæsthesia.

ST. AGNES HOSPITAL

Tuesday

E. C. MURPHY—9. Dry clinic: Exhibition of fracture cases with end-results by operative and non-operative procedures.
JOHN F. X. JONES—9. General surgery, operative clinic.
JOHN A. MCGLINN—9. Gynecology. Exhibition of patients treated for acute inflammatory diseases by means of nonspecific proteins. Demonstration of method of treatment of gonorrhœa in the female by heat.

Wednesday

G. M. DORRANCE and J. W. BRANSFIELD—9. Operative clinic and demonstration of cases. Cleft palate cases operated on by the new method, elongation of palate.
JOHN M. FISHER—9. Gynecology.
WILBUR B. HAINES—2. Genito-urinary surgery.
J. C. HIRST and staff—2. Gynecology and obstetrics.

MEDICO-CHIRURGICAL HOSPITAL

Tuesday

J. B. CARNETT—9. General surgery.
GEORGE M. BOYD—11. Gynecology.

Wednesday

GEORGE W. OUTERBRIDGE—9. Cystoscopy.
WILLIAM R. NICHOLSON—9. Gynecology.

Friday

J. B. CARNETT—9. General surgery.
GEORGE M. BOYD—11. Gynecology.

NORTHEASTERN HOSPITAL

Wednesday

H. Z. HIBSHMAN—9. Anorectal infections.
T. TURNER THOMAS—10. General surgery.
JOHN B. LOWNES and J. A. BROADFIELD—3. Operative and cystoscopic clinic.

Thursday

T. TURNER THOMAS—2. Dry clinic: Results with non-operative reduction, especially of wrist, elbow, shoulder, hip, and ankle. Operative reductions. Compound fractures. Recurrent dislocations of shoulder. Brachial birth palsy.

UNIVERSITY HOSPITAL

Tuesday

JOHN G. CLARK, C. C. NORRIS, and F. E. KEENE—9. Gynecology.
C. H. FRAZIER, F. GRANT, and TEMPLE FAY—9. Neurosurgery.
B. C. HIRST, E. B. PIPER, J. C. HIRST, II, J. K. JAFFE, G. V. JANVIER, and W. BENSON HARER—9. Obstetrics and gynecology.
GEORGE P. MULLER and I. S. RAVDIN—9. General surgery.
A. BRUCE GILL—9. Orthopedics.
CHEVALIER JACKSON and GABRIEL TUCKER—3. Bronchoscopy.

Wednesday

JOHN G. CLARK, C. C. NORRIS, and F. E. KEENE—9. Gynecology.
E. L. ELIASON and DRURY HINTON—9. General surgery.
A. RANDALL, S. W. MOORHEAD, P. S. PELOUZE, and MAURICE MUSCHAT—2. Urology.

Thursday

JOHN G. CLARK, C. C. NORRIS, and F. E. KEENE—9. Gynecology.
C. H. FRAZIER, F. GRANT, and TEMPLE FAY—9. Neurosurgery.
B. C. HIRST, E. B. PIPER, J. C. HIRST, II, J. K. JAFFE, G. V. JANVIER, and W. B. HARER—9. Obstetrics and gynecology.
G. P. MULLER and I. S. RAVDIN—9. General surgery.
A. BRUCE GILL—9. Orthopedics.
CHEVALIER JACKSON and GABRIEL TUCKER—3. Bronchoscopy.

Friday

JOHN G. CLARK, C. C. NORRIS, and F. E. KEEN —9. Gynecology.
C. H. FRAZIER, F. GRANT, and TEMPLE FAY—9. Neurosurgery.
B. C. HIRST, E. B. PIPER, J. C. HIRST, II, J. K. JAFFE, G. V. JANVIER, and W. B. HARER—9. Gynecology and obstetrics.
E. L. ELIASON and DRURY HINTON—9. General surgery.
A. BRUCE GILL—9. Orthopedics.

JEWISH HOSPITAL

Tuesday

M. BEHREND—9. General surgery.
W. H. TELLER—2. General surgery.

Wednesday

F. B. BLOCK—9. General surgery.
L. BRINKMAN—2. General surgery.

Thursday

M. BEHREND—9. General surgery.
F. B. BLOCK—2. General surgery.

Friday

L. BRINKMAN—9. General surgery.
W. H. TELLER—2. General surgery.

WOMEN'S HOMEOPATHIC HOSPITAL

Tuesday

JOHN A. BROOKE—2. Orthopedics.

Wednesday

ARTHUR HARTLEY—2. General surgery.

Friday

FRANCOIS L. HUGHES—10. Gynecology.

PHILADELPHIA GENERAL HOSPITAL

Tuesday

FRANK C. HAMMOND—10. Gynecological operations.
WILLIAM H. MACKINNEY—2. Genito-urinary operations.

Wednesday

ALFRED C. WOOD—9. General surgery.
J. T. RUGH—11. Orthopedic surgery.
STAFF—2. Symposium on Cancer: J. B. CARNETT, general surgery; HENRY K. PANCOAST, Radiology; C. C. NORRIS, gynecology; J. F. SCHAMBERG, dermatology; ROBERT G. TORREY, medical; GEORGE M. DORRANCE, faciomaxillary; F. O. LEWIS, laryngology. Visit to radium emanation plant and deep therapy laboratories.

Thursday

J. B. CARNETT, J. RALSTON WELLS, ROBERT BRADLEY and JAMES P. WEATHERWAX—9. Non-operative cancer clinic.
EDWARD A. SCHUMANN—2. Gynecological operations.

Friday

T. T. THOMAS—9. General surgery.
C. C. NORRIS—11. Gynecological clinic, cancer operations.
EDWARD B. KRUMBHAAR and staff of pathologists—4. Clinicopathological conference, demonstrating current interesting pathological conditions and specimens. Open discussion is invited at this conference.

ST. JOSEPH'S HOSPITAL

Tuesday

JOSEPH M. SPELLISSY—9. Dry clinic: Operative mechanical treatment of some of the effects of infantile paralysis.
JOHN F. X. JONES—11. General surgery; appendectomy, gall-bladder disease.

Wednesday

MELVIN M. FRANKLIN—9. General surgery; influence of prosthetics upon amputations; chronic, nontuberculous suppuration in bone.
F. HURST MAIER—11. Gynecology; hysterectomy for myofibromata, plastic for procidentia, suspension for retroflexion.

Thursday

JAMES A. KELLY—9. General surgery; fracture clinic.

Friday

CHARLES F. NASSAU—9. General surgery; subtotal thyroidectomy under local anæsthesia, hernioplasty under local anæsthesia.
P. BROOKE BLAND—11. Gynecology; application of radium for uterine myofibromata, trachelorrhaphy and perineorrhaphy, abdominal hysterectomy.

NORTHWESTERN GENERAL HOSPITAL

Tuesday

J. O. ARNOLD—2. Obstetrical clinic. Perineotomy, an improved technique.

Wednesday

J. T. SCHELL—9. General surgery.

Thursday

ARTHUR D. KURTZ—3:30. Orthopedic dry clinic.

Friday

ROBERT BOYER—11. Genito-urinary clinic. Suprapubic prostatectomy.

LANKENAU HOSPITAL

Tuesday

STANLEY P. REIMAN—9. Demonstrations in new laboratory.
A. G. MILLER and ROBERT SHOEMAKER—11. Demonstration in roentgenology.
F. L. HARTMAN—11. Demonstration of follow-up system.

Wednesday

STANLEY P. REIMAN—9. Demonstration in new laboratory.
F. L. HARTMAN—11. Demonstration of follow-up system.
A. G. MILLER and ROBERT SHOEMAKER—11. Demonstration in roentgenology.
JOHN B. DEAVER—12. General surgery.

Thursday

F. L. HARTMAN—11. Demonstration of follow-up system.
A. G. MILLER and ROBERT SHOEMAKER—11. Demonstration in roentgenology.
JOHN B. DEAVER—12. General surgery.
WILLIAM H. MACKINNEY—5:30. Cystoscopy.

Friday

STANLEY P. REIMAN—9. Demonstration in new laboratory.
A. G. MILLER and ROBERT SHOEMAKER—11. Demonstration in roentgenology.
F. L. HARTMAN—11. Demonstration of follow-up system.

METHODIST EPISCOPAL HOSPITAL

Tuesday

JAMES H. BALDWIN—9. Gas gangrene, foreign body in bladder, fractures of patella, foreign body in brain.
MILTON F. PERCIVAL—9. Daily demonstrations of X-ray technique, fluoroscopy, pyelograms, electrocoagulation, radio knife, and photography.

Wednesday

WILLIAM R. NICHOLSON—9. Vesicovaginal fistula, cystocele, prolapse of uterus, cervical repairs and repairs of perineum.
LEVI JAY HAMMOND—2. Surgery of gall tracts, stomach, spleen, and pancreas.

Thursday

DAMON B. PFEIFFER—9. Carcinoma of the rectosigmoid, blood transfusions, surgery of the gall bladder, stomach, and intestines.
RICHARD C. NORRIS—2. Abdominal gynecology, retroversion, uterine and ovarian tumors, cæsarean section.

Friday

J. T. RUGH—9. Arthrodesis, correction of paralytic deformities, stabilization of the hip joint and spinal bone grafts.
LEON HERMAN—1. Prostatectomy, renal calculus, hypernephroma, malignant tumors of the bladder, cystoscopy, and pyelography.

KENSINGTON HOSPITAL FOR WOMEN

Tuesday

WILLIAM E. PARKE—11. Prenatal clinic, history taking, pelvimetry, blood-pressure records, obstetrical analgesia.
H. C. DEAVER—12:30. General surgical clinic.

Friday

DANIEL LONGAKER—11. Potter version statistics and demonstration of available material.

CHILDREN'S HOSPITAL

Tuesday

J. H. JOPSON—9. Diagnosis in surgical diseases of the abdomen.
J. C. GITTINGS—9. Some medical aspects of surgical cases.
C. W. BURR and F. E. LEAVITT—9. Neurosurgical problems in children.
C. C. NORRIS—2. Vaginitis in infants and young children; methods of treatment.

Wednesday

W. ESTELL LEE and J. R. WELLS—9. Problems in thoracic surgery. Treatment of burns.
R. S. BROMER—9. X-ray in thoracic and gastro-intestinal lesions.

Thursday

HOWARD C. CARPENTER—9. Health examination in children.
EMILY P. BACON—9. Demonstration of nutritional work in children.
SUSAN C. FRANCIS, R. N.—9. Problems in management of surgical wards.

Friday

JOHN SPEESE and W. EDGAR CHRISTIE—9. Postoperative management of surgical cases.
HENRY P. BROWN and ERNEST G. WILLIAMSON—9. Management of the surgical out-patient department.

MT. SINAI HOSPITAL

Tuesday

CHARLES F. NASSAU—9. Radical cure of hernia, local anæsthesia.
G. ROSENBAUM—12. X-rays of gastro-intestinal tract.

Wednesday

M. BEHREND—9. Surgery of bile passageways and gastro-intestinal tract. Presentation of cases.
M. COOPERMAN—2. Gonorrhœal arthritis, dislocation of hip, astragalectomy, Whitman reconstruction operation.
G. TUCKER—4. Bronchoscopy and œsophagoscopy.

Thursday

J. C. HIRST—9. Prolapse of uterus, cystoscopy, vaginal repair.
G. ROSENBAUM—12. X-rays of gastro-intestinal tract.
G. TUCKER—4. Bronchoscopy and œsophagoscopy.

Friday

C. MAZER—9. Plastic, Rubin test, and pyelography.
C. HIRSH—11:30. Demonstration of cases.

AMERICAN ONCOLOGIC HOSPITAL

Tuesday

W. S. NEWCOMET—10. Cases of angioma, treated and under treatment, selected from a group of 200.
SAMUEL MCCLARY, 3rd—10. Cases of cancer of the lip and mouth.

Wednesday

W. S. NEWCOMET and SAMUEL MCCLARY, 3rd—9:30. Cases of malignant diseases being treated with radium: cases of angioma, cancer of the lip, birth mark.

Friday

W. S. NEWCOMET and SAMUEL MCCLARY, 3rd—9:30. Cases of malignant diseases being treated with radium; review of goiter cases treated with radium.

HAHNEMANN HOSPITAL

Tuesday

L. T. Ashcraft, William C. Hunicker, Frank C. Benson, Jr.—9. Urologic clinic. Symposium on tumors of the urinary bladder and on carcinoma of the prostate. Demonstration of local anæsthesia.

J. E. James, Jr., and Leon Clemmer—10. Obstetrical clinic. Salient points in pelvimetry. The rôle of version in obstetrical surgery. Cervico-abdominal hysterectomy.

F. W. Smith—2. Bronchoscopic work on the cadaver.

F. C. Benson, Jr.—3. Radium clinic. Technique of application and results in superficial malignant tumors. Limitations, contra-indications, and dangers in radium therapy.

Wednesday

H. L. Northrop—9. Thoracic surgery.

D. B. James and E. B. Craig—9. Gynecological clinic. Malignancy of the uterus.

W. C. Mercer and J. B. Bert—10. Obstetrical clinic. Forceps application with special reference to the cephalic application in posterior oblique positions. The mechanism of labor.

S. W. Sappington—3. Demonstration of various methods of blood transfusion.

Thursday

J. D. Elliott and William M. Sylvis—9. Operative clinic. Tumors of the breast. Discussion of the pathology and end-results of treatment by X-rays, radium, and operation.

D. B. James—9. Gynecological clinic.

O. B. Waite and N. F. Paxson—10. Obstetrical clinic. Prenatal care. Practical results of routine Wassermann tests. Pre-eclampsia and eclampsia. Fetal mortality.

J. A. Brooke—2. Orthopedic clinic. Shortening of bones of the leg to correct inequality in length. Demonstration of new bone skid. Results of astragalectomy in paralytic foot.

J. W. Frank—3. Roentgenologic clinic. Comparison of newer forms of roentgen treatment for malignancy with former methods. Presentation of patients.

Friday

G. A. Van Lennep and H. P. Leopold—9. Surgery of the stomach and duodenum.

N. F. Lane and D. W. Culin—9. Uterine bleeding, diagnosis and treatment.

ORTHOPEDIC HOSPITAL

Tuesday

Astley P. C. Ashhurst, Rutherford L. John, Edward T. Crossan, and B. F. Buzby—1. Orthopedic demonstration.

Thursday

Astley P. C. Ashhurst, Rutherford L. John, Edward T. Crossan, and B. F. Buzby—9. Orthopedic operations.

Friday

A. Bruce Gill, C. R. Bowen, and James E. Wyant. Orthopedic clinic.

ST. CHRISTOPHER'S HOSPITAL

E. G. Alexander—10. Surgical clinic: Hernia, appendix, pyloric stenosis, undescended testicle, harelip, empyema and bone cases. Surgery in children.

WOMAN'S HOSPITAL

Tuesday

Sarah H. Lockrey and Emily Whitten-Auge—9. Gynecological clinic.

Lida Stewart-Cogill and Elizabeth Hughes—2. Obstetrical clinic.

Julia Hardin. Demonstration of gas-oxygen and ethylene anæsthesia.

Wednesday

Marie K. Formad and Alberta Peltz—9. Gynecological clinic.

Ella Williams Grim and Alberta Peltz—3. Obstetrical clinic.

Julia Hardin. Demonstration of gas-oxygen and ethylene anæsthesia.

Thursday

Catharine Macfarlane and Faith S. Fetterman—9. Gynecological clinic.

Kate W. Baldwin—10. General surgery.

Mary Lewis and Della Mildazias—3. Obstetrical clinic.

Julia Hardin. Demonstration of gas-oxygen and ethylene anæsthesia.

Friday

Elizabeth F. C. Clark—10. Gynecological clinic.

Ann Tomkins Gibson and Jessie W. Pryor—2. Obstetrical clinic.

Emily Whitten-Auge—3. General surgery.

Julia Hardin. Demonstration of gas-oxygen and ethylene anæsthesia.

ST. LUKE'S HOSPITAL

Tuesday

Desiderio Roman—9. General surgery.

O. F. Barthmaier—11. Demonstration of blood transfusion.

Wednesday

A. B. Webster—9. General surgery.

J. Walter Post—11. Demonstration in roentgenology.

William C. Hunsicker and J. Miller Kenworthy—2. Genito-urinary surgery and cystoscopy.

Thursday

Desiderio Roman—9. Operations upon thyroid and demonstration of group study of thyroid disease.

Friday

A. B. Webster—9. General surgery.

J. Walter Post—11. Demonstration in roentgenology.

William C. Hunsicker and J. Miller Kenworthy—2. Genito-urinary surgery and cystoscopy.

CHILDREN'S HOMEOPATHIC HOSPITAL

Tuesday

H. P. Leopold—2. General surgery.

Wednesday

John Brooke—2. Orthopedic clinic: After-results in epiphyseal fractures; club hand; syphilitic joints; joint changes in endocrine disturbances.

Thursday

A. Korndoerfer, Jr.—2. Obstetrical clinic.

STETSON HOSPITAL

Tuesday

JOHN A. BOGER and WILLIAM T. ELLIS—1. General surgery; herniotomy, appendectomy, cholecystotomy, reduction of fractures.

Wednesday

S. E. TRACY and Associates—9. Gynecological clinic. Plastic operations, trachelorrhaphy, trachelectomy, anterior colporrhaphy, perineorrhaphy, myomectomy and hysterectomy for fibroids, shortening of the round ligaments, conservative operations for pelvic inflammatory conditions.

Thursday

BROOKE M. ANSPACH and Associates—9. Gynecological clinic.

Friday

S. E. TRACY and Associates—9. Gynecological clinic.
CARL F. KOENIG—1. Roentgenology. Diagnostic and deep therapy clinic.

WOMAN'S COLLEGE HOSPITAL

Tuesday

LIDA STEWART-COGILL—9. Prenatal clinic.

Wednesday

J. S. RODMAN and staff—9. General surgery.

Thursday

CATHARINE MACFARLANE—2. Gynecology.

Friday

J. S. RODMAN and staff—9. General surgery.

COOPER HOSPITAL (Camden)

Tuesday

THOMAS B. LEE, ALBERT B. DAVIS, and GORDON WEST—9. Gynecology.

Wednesday

PAUL M. MECRAY and Associates—10. General surgery.
A. HAINES LIPPINCOTT and DAVID BENTLEY, JR.—2:30. Genito-urinary and rectal clinic.
B. F. BUZBY—2:30. Orthopedic clinic.

Thursday

THOMAS B. LEE, ALBERT B. DAVIS, and GORDON WEST—9. Gynecology.

Friday

PAUL M. MECRAY and Associates—10. General surgery.
B. F. BUZBY—2:30. Orthopedics.

CHESTNUT HILL HOSPITAL

Tuesday

ANDREW GODFREY and WILLIAM SHEEHAN—10. General surgery.
ALEX RANDALL—2. Urological clinic.

Wednesday

J. MURRAY ELLZEY—10. Fracture clinic.

Thursday

J. F. MCCLOSKEY—10. General surgery.

EVANS INSTITUTE

R. H. IVY and LAWRENCE CURTIS—Wednesday, 10. Oral surgery.

SURGERY OF THE EYE, EAR, NOSE AND THROAT

CLINICAL DEMONSTRATIONS AND PAPERS

Ballroom, Bellevue-Stratford

Tuesday—9 a.m.

Group conference on problems related to the Hospital Standardization Program as applied to ophthalmological and otolaryngological services. J. A. BABBITT, Chairman.

Wednesday—9 a.m.

PHILIP FRANKLIN, London, England: The Clinical Aspect of Tonsils.
Discussion: GEORGE B. WOOD, Philadelphia; C. W. RICHARDSON, Washington; C. G. COAKLEY, New York.

CHEVALIER JACKSON, Philadelphia: Laryngofissure for Cancer of the Larynx.
Discussion: HARMON SMITH, New York; H. W. LOEB, St. Louis; LOUIS H. CLERF, Philadelphia.

HARRY S. GRADLE, Chicago: The Practical Use of the Slit Lamp in Daily Routine.
Discussion: HUNTER H. MCQUIRE, Winchester, Va.; ALFRED COWAN, Philadelphia; LUTHER C. PETER, Philadelphia.

DOUGLAS QUICK, New York: Use of Radium and X-ray in the Treatment of Malignant Disease of the Paranasal Sinuses.
Discussion: D. CROSBY GREENE, Boston; CHARLES E. PANCOAST, Philadelphia; G. E. PFAHLER, Philadelphia.

JOHN E. MACKENTY, New York: Laryngectomy in One Stage, Comments on One Hundred Operations.
Discussion: FIELDING O. LEWIS, Philadelphia.

Thursday—9 a.m.

F. EARNEST WHITNALL, Montreal, Canada: Tenon's Capsule.

J. C. BECK, Chicago: Some of the Important Complications from Ear, Nose and Throat Diseases and Operations and Their Management.
Discussion: GEORGE M. COATES, Philadelphia; RALPH BUTLER, Philadelphia.

E. C. ELLETT, Memphis, Tenn.: The Use of the Suture in Cataract Extraction.
Discussion: LEWIS ZIEGLER, Philadelphia; WILLIAM ZENTMAYER, Philadelphia.

WELLS P. EAGLETON, Newark, N. J.: Meningitis of Aural Origin.
Discussion: S. MACCUEN SMITH, Philadelphia; JAMES A. BABBITT, Philadelphia; H. I. LILLIE, Rochester, Minn.

T. E. CARMODY, Denver: Observations of Children's Sinuses in Health and Diseases.
Discussion: ROSS H. SKILLERN, Philadelphia; LEON E. WHITE, Boston.

Friday—9 a.m.

MAJOR EDMUND B. SPAETH, Takoma Park, Md.: Ophthalmic Plastic Surgery. Lantern slide demonstration.

GEORGE M. DORRANCE, Philadelphia: Rhinoplasty, presentation of cases and lantern slide demonstration.

WARREN B. DAVIS, Philadelphia: Some Types of Harelip and Cleft-palate Deformities and Their Operative Results. Presentation of patients and lantern slide demonstration.

CHARLES F. NASSAU, Philadelphia: Closure of Laryngostomic Fistulæ. Lantern slide and moving picture demonstration.

EPISCOPAL HOSPITAL

Tuesday

W. R. WATSON, E. W. COLLINS, O. C. HIRST, and J. H. SCHAEFFER—2. Otolaryngology.
HAROLD G. GOLDBERG, D. J. BOONE, and WILLIAM H. CHANDLEE—2. Ophthalmology.

Wednesday

A. G. FEWELL, W. S. REESE, J. B. RUDOLPH, and F. HERBERT, JR.—2. Ophthalmology.
W. R. WATSON, E. W. COLLINS, O. C. HIRST, and J. H. SCHAEFFER—2. Otolaryngology.

Thursday

FREDERICK KRAUSS and J. B. FELDMAN—2. Ophthalmology.
CHARLES C. BIEDERT, T. R. CURRIE, and WILLIAM MATTHEWS—2. Otolaryngology.
A. G. FEWELL, W. S. REESE, J. B. RUDOLPH, and F. HERBERT, JR.—2. Ophthalmology.

Friday

C. C. BIEDERT, T. R. CURRIE, and WILLIAM MATTHEWS—2. Otolaryngology.
HAROLD G. GOLDBERG, D. J. BOONE, and W. H. CHANDLEE—2. Ophthalmology.

POLYCLINIC HOSPITAL

Tuesday

T. B. HOLLOWAY—2. Ophthalmology.

Wednesday

WALTER ROBERTS—2. Otolaryngology.
E. B. GLEASON—3. Otolaryngology.
L. C. PETER—3. Ophthalmology.

Thursday

GEORGE B. WOOD—3. Laryngology.

Friday

RALPH BUTLER—3. Laryngology.

HOWARD HOSPITAL

Tuesday

G. B. WOOD—2. Laryngology.

Wednesday

W. C. POSEY—2. Operations on the eye.

Thursday

G. B. WOOD—2. Laryngology.

Friday

W. C. POSEY—2. Ophthalmology.

ST. AGNES HOSPITAL

Tuesday

BENJAMIN D. PARISH—2. Otolaryngology.

Wednesday

WARREN B. DAVIS—2. Otolaryngology.
GEORGE F. J. KELLY—2. Ophthalmology.

ST. JOSEPH'S HOSPITAL

Tuesday

GEORGE M. MARSHALL—2. Otolaryngology; osteoplastic correction of the nasal bones, radical maxillary sinus operation.

PAUL J. PONTIUS—2. Ophthalmology; enucleation with gold ball insertion, iridectomy.

Wednesday

CHARLES J. JONES—2. Ophthalmology; preliminary iridectomy for cataract, simple extraction.

WILLIAM E. QUICKSALL—2. Otolaryngology; tonsillectomy by Fetterolf's method, submucous resection.

Thursday

THOMAS A. O'BRIEN—2. Ophthalmology; combined extraction, Elliott trephine for glaucoma.

ARTHUR WRIGLEY—2. Otolaryngology; replacement of laterally displaced tip of quadrangular cartilage with submucous resection, tonsillectomy by decapsulation with dissection and snare.

CORNELIUS T. MCCARTHY—2. Otolaryngology; radical mastoidectomy, ethmoidectomy.

JEFFERSON HOSPITAL

Thursday

FIELDING O. LEWIS—2. Otolaryngology.

Friday

HOWARD F. HANSELL and WILLIAM M. SWEET—2. Ophthalmology.

S. MACCUEN SMITH and J. CLARENCE KEELER—2. Otology.

MISERICORDIA HOSPITAL

Tuesday

JOHN E. LOFTUS—2. Otolaryngology.

Wednesday

C. T. MCCARTHY—2. Otolaryngology.

HAROLD GOLDBERG—3. Ophthalmology.

Thursday

JOHN E. LOFTUS—2. Otolaryngology.

JOHN A. COLGAN—3. Ophthalmology.

Friday

C. T. MCCARTHY—2. Otolaryngology.

WOMAN'S COLLEGE HOSPITAL

Tuesday

MARGARET F. BUTLER—2. Otolaryngology.

Friday

MARY BUCHANAN—3. Ophthalmology.

JEWISH HOSPITAL

Wednesday

J. KNIPE—3. Eye clinic.

Thursday

S. MCC. SMITH and A. S. KAUFMAN—3. Otological clinic.

H. M. GODDARD—4. Nose and throat clinic.

WILLS EYE HOSPITAL

Tuesday

BURTON CHANCE, FRANK C. PARKER, LEIGHTON F. APPLEMAN, and BENJAMIN F. BAER, JR.—2. Ophthalmic operations.

Wednesday

WILLIAM ZENTMAYER, PAUL J. PONTIUS, J. MILTON GRISCOM, and THOMAS A. O'BRIEN—2. Ophthalmic operations.

Thursday

BURTON CHANCE, FRANK C. PARKER, LEIGHTON F. APPLEMAN, and BENJAMIN F. BAER, JR.—2. Ophthalmic operations.

Friday

WILLIAM ZENTMAYER, PAUL J. PONTIUS, J. MILTON GRISCOM, and THOMAS A. O'BRIEN—2. Ophthalmic operations.

UNIVERSITY HOSPITAL

Tuesday

THOMAS B. HOLLOWAY—2. Ophthalmology.

G. FETTEROLF, J. A. BABBITT, D. HUSIK, and LEWIS FISHER—3. Otolaryngology.

Wednesday

G. FETTEROLF, J. A. BABBITT, D. HUSIK, and L. FISHER—3. Otolaryngology.

Thursday

THOMAS B. HOLLOWAY—2. Ophthalmology.

Friday

THOMAS B. HOLLOWAY—2. Ophthalmology.

GEORGE FETTEROLF, J. A. BABBITT, DAVID HUSIK and LEWIS FISHER—2. Otolaryngology.

MT. SINAI HOSPITAL

Tuesday

L. FISHER—2. Tonsil and sinus surgery. Bárány test.

C. W. LEFEVER—4. Cataract, glaucoma, muscle work.

Thursday

S. J. GITTELSON—2. Demonstration of cases.

Friday

A. W. WATSON—2. Mastoid and tonsil surgery.

METHODIST EPISCOPAL HOSPITAL

Tuesday

WALTER ROBERTS—2. Deviated septum, tonsillectomies and adenoidectomies, mastoid disease and malignant disease of the larynx, bronchoscopy.

PHILIP H. MOORE—4. Enucleation, foreign body in the eye, strabismus, glaucoma.

CHILDREN'S HOSPITAL

Wednesday

H. MAXWELL LANDON and A. R. RENNINGER—2. Ophthalmology.

Thursday

JAMES A. BABBITT and Staff—2. Otolaryngology.

MEDICO-CHIRURGICAL HOSPITAL

Tuesday

GEORGE M. COATES—2. Otolaryngology.

Wednesday

ROSS H. SKILLERN—2. Laryngology.

Thursday

GEORGE M. COATES—2. Otolaryngology.

Friday

ROSS H. SKILLERN—2. Laryngology.

ST. MARY'S HOSPITAL

Tuesday

FRANK MURPHY—2. Eye clinic.

Wednesday

EDWARD MURPHY, WILLIAM P. GRADY, and ALBERT J. DEVLIN—3. Otolaryngology.

HAHNEMANN HOSPITAL

Tuesday

G. J. PALEN—2. Résumé of mastoid operation by otological department.

Thursday

H. S. WEAVER and C. B. HOLLIS—2. Nose and throat clinic.

Friday

F. O. NAGLE—2. Eye clinic. Pathology of the eye.

STETSON HOSPITAL

CARLE L. FELT and Associates—1. Otolaryngological clinic: Tonsillectomy and adenoidectomy, mastoidectomy, resection of septum.

NORTHEASTERN HOSPITAL

Wednesday

GEORGE E. SHAFFER—2. Caldwell-Luc operation.
GRANVILLE A. LAWRENCE—4. Ophthalmology.

UNIVERSITY OF PENNSYLVANIA MEDICAL SCHOOL

E. B. GLEASON and PHILIP S. STOUT. Operative work on the mastoid and labyrinth. Demonstration on the cadaver.

SAMARITAN HOSPITAL

LUTHER C. PETER—Tuesday, 4. Ophthalmology.

PRESBYTERIAN HOSPITAL

Friday

NATHAN P. STAUFFER, W. L. CARISS, and O. R. KLINE—2. Otolaryngology.
H. MAXWELL LANGDON and J. MONROE THORINGTON—2. Ophthalmology.

WOMAN'S HOSPITAL

Tuesday

LAURA E. HUNT and MARY HIPPLE—2. Otolaryngology.

Wednesday

MARGARET A. WARLOW—1:30. Otolaryngology.
MARY BUCHANAN—2. Ophthalmology.

Thursday

MARGARET F. BUTLER and LOIS VAN LOON—2. Otolaryngology.

CHESTNUT HILL HOSPITAL

Wednesday

BENJAMIN PARISH and JOHN DAVIES—2. Otolaryngology.

Thursday

CARL WILLIAMS—2. Ophthalmology.

COOPER HOSPITAL (Camden)

Tuesday

L. B. HIRST, E. R. HIRST, and ALFRED ELWELL—2:30. Otolaryngology.

Thursday

L. B. HIRST, E. R. HIRST, and ALFRED ELWELL—2:30. Otolaryngology.

FRANKFORD HOSPITAL

Tuesday

FRANK EMBERY—9:30. Tonsil and mastoid clinic.
W. J. WATSON—9:30. Tonsil clinic.

CHILDREN'S HOMEOPATHIC HOSPITAL

FRED W. SMITH—Tuesday, 2. Laryngological clinic, hypertrophied tonsils and adenoids.

WOMEN'S HOMEOPATHIC HOSPITAL

JOSEPH F. V. CLAY—Thursday, 2. Otolaryngology.

PHILADELPHIA GENERAL HOSPITAL

DAVID N. HUSIK—Friday, 2. Otolaryngological operations.

SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE, PUBLISHED MONTHLY

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URETERAL STRICTURES, KINKS, AND ABNORMAL INSERTS[1]

DANIEL N. EISENDRATH, A.B., M.D., F.A.C.S., CHICAGO

ALTHOUGH there is much difference of opinion in regard to the frequency and clinical importance of ureteral strictures, we are indebted to Hunner for directing our attention to the necessity of using special bougies supplemented by ureteropyelography in searching for these conditions. The latter method has revealed that two other ureteral conditions, viz., kinks and abnormal insertions into the renal pelvis, can be more easily demonstrated than has ever before been possible and hence must also be taken into consideration when an attempt is made to interpret the source of symptoms such as abdominal pain or those more strictly referable to the urinary tract. For this reason it has been deemed advisable to consider strictures, kinks, and abnormal inserts together.

Here, as elsewhere, a knowledge of what is normal is essential; hence, let us first take up this portion of the subject.

ANATOMY OF THE URETER[2]

Length. According to Schwalbe, Zondek, and Waldeyer, the ureter varies in length in men from 28 to 34 centimeters, the right being 1 centimeter shorter than the left. In women, the average length of the left ureter is 29 centimeters, and of the right 27.5.

Variations in caliber. Studies at all periods of prenatal and postnatal life have revealed four levels at which the lumen is narrow, and three where it is wider. They are easily seen in fetal specimens (Fig. 1), in casts[3] of adult ureters (Figs. 2 and 3), as well as in ureteropyelograms of apparently normal individuals (Fig. 4). These anatomical and clinical observations reveal much variation in the caliber of the ureter at different levels. The following table will give the diameter and the size of a ureteral catheter or bougie, which can be introduced under normal conditions.

Location	Diameter	Size catheter or bougie
Ureteropelvic junction	2 mm.	6 French
Lumbar spindle	10 mm.	30 French
At iliac crossing	4 mm.	12 French
Pelvic spindle	4–6 mm.	12 to 18 French
Juxtavesical	1–5 mm.	3 to 15 French
Intramural	3–4 mm.	9 to 12 French

An occasional glance at such figures is of the utmost importance in our examination of cases for suspected strictures.

VALUE OF URETEROPYELOGRAPHY

As will be mentioned later, ureteropyelography, in my opinion, is an indispensable part of our clinical examination, but we must learn to interpret the films after consideration of the following:

1. There may be considerable deviation from the classical type of ureter shown in Figures 2 and 3. The levels at which the narrowings occur may be higher or lower, and

[1] The description of the various layers of the ureter, as well as its vascular, lymphatic, and nerve supply, has been omitted.

[2] I am indebted to Dr. W. E. Holland for permission to use some of the material collected by the late Dr. Byron Robinson and himself.

Read at the meeting of the Genito-Urinary Section of the Academy of Medicine of New York City, April 22, 1925.

Fig. 1. Autopsy specimen from ten day old infant. Note from above downward on left side, the narrowing at junction of renal pelvis with ureter, the relatively small lumbar spindle, the narrowing at crossing of iliac vessels, the large spindle-like dilatation of pelvic portion of ureter, and, finally, the narrowing (juxtavesical) near the entrance to the bladder wall.

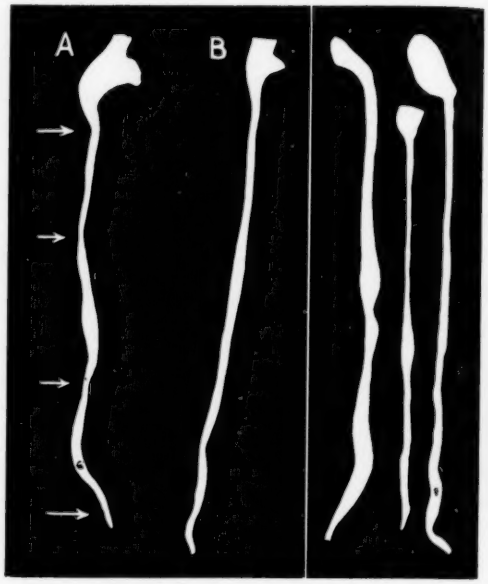

Fig. 2 (left). Casts of normal adult ureters made by Drs. Byron Robinson and William E. Holland. A. Arrows point to the four narrowings; viz., from above downward, ureteropelvic junction, upper portion of lumbar ureter, crossing of iliac vessels, and juxtavesically. Compare with Figure 1, where upper lumbar narrowing is absent. B. Cast showing only a more diffuse narrowing in lumbar ureter, another at crossing of iliac vessels, and a third juxtavesical.

Fig. 3. Three casts (Robinson and Holland) showing marked deviation from the normal levels of narrowing. Such variations must be taken into consideration in interpreting pyelograms.

the narrowing (Fig. 5) may extend over an unusually large section of the ureter.

2. In certain normal individuals who present no clinical symptoms on the side on which a ureteropyelogram has been made for purposes of comparison, a kink may be found (Fig. 6), as a result of a redundancy or folding up of the normal ureter.

3. A kink may be artificially produced if only one picture is taken; i.e., without withdrawing the opaque catheter and making a second exposure (Fig. 7).

Dr. R. A. Arens[1] and myself have been greatly interested in a study of whether or not the ureter of an apparently normal individual will show a wider shadow when a large quantity of the opaque medium is injected under considerable pressure. This is of the utmost importance in the interpretation of films made in cases in which stricture is suspected. We obtained the urinary organs intact at the autopsy of a man who died following a stab wound of the neck. Ureteral catheters were inserted transvesically and tied in place so as to prevent back flow into the bladder. When 10 cubic centimeters of opaque medium was injected on each side, with as much pressure as is ordinarily employed in making a ureteropyelogram, the film revealed a shadow with all of the normal levels of narrowing and widening (A of Fig. 8). When 20 cubic centimeters were injected under considerable pressure on both sides, there was practically no change in the shadow (B of Fig. 8), but, as you will note, the fluid was forced into the renal parenchyma, as occurred in our collargol experiments. This observation would indicate that the amount of fluid and pressure play but little part in widening the shadow of the ureter. We must remember, however, that when inflammatory changes, especially those of long standing, are present in the

[1] Radiologist to the Michael Reese Hospital.

Fig. 4.

Fig. 5, A.

Fig. 5, B.

Fig. 4. Normal ureteropyelogram. Observe narrowings between which the spindles are well marked. Note shortness of lumbar narrowing as compared to longer one in Figure 5.

Fig. 5. Normal ureteropyelogram. A. Almost complete absence of ureteropelvic narrowing and presence of long lumbar narrowing. Note marked narrowing where ureter crosses iliac vessels and at entrance into bladder. B. Normal ureter showing redundancy and tendency to kink formation.

ureteral wall a wider shadow (Fig. 9) is the rule.

The possibility of the existence of such an inflammatory dilatation must be considered in the interpretation of a relatively wide shadow when stricture is suspected.

STRICTURES OF THE URETER

I will limit myself to the discussion of the following questions, concerning which there is still much difference of opinion.

1. Are all strictures seen in children and adults to be regarded as of inflammatory origin?

2. Are strictures as frequent as Hunner and others would have us believe, and are their methods of examination free from criticism?

Taking up the first question, we agree that strictures of the ureter are to be found before birth and that they occur at the levels (Figs. 1, 2, and 3) where the ureter is normally

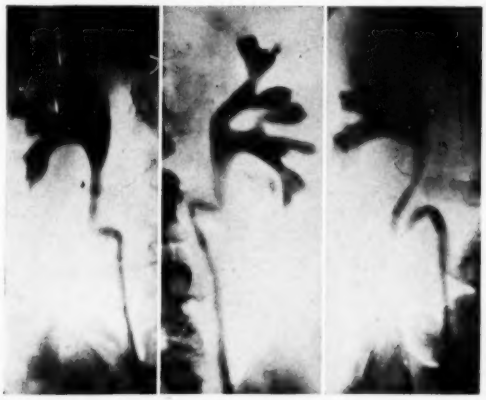

Fig. 6. Well marked kinks found by accident in cases in which bilateral ureteropyelograms were made. There were no subjective symptoms, and no urological findings on the side from which these were made.

narrower. In a previous contribution[1] I reported 6 cases which could be most easily explained as being of congenital origin and a

[1] Surg. Clin. North America, 1924, iv, 635.

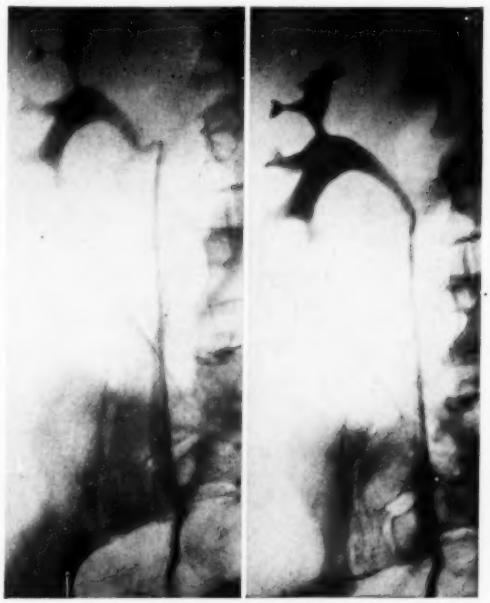

Fig. 7. How an apparent kink can be produced artificially. Roentgenogram at left taken while catheter is close to kidney; at right, after withdrawal of catheter for a short distance.

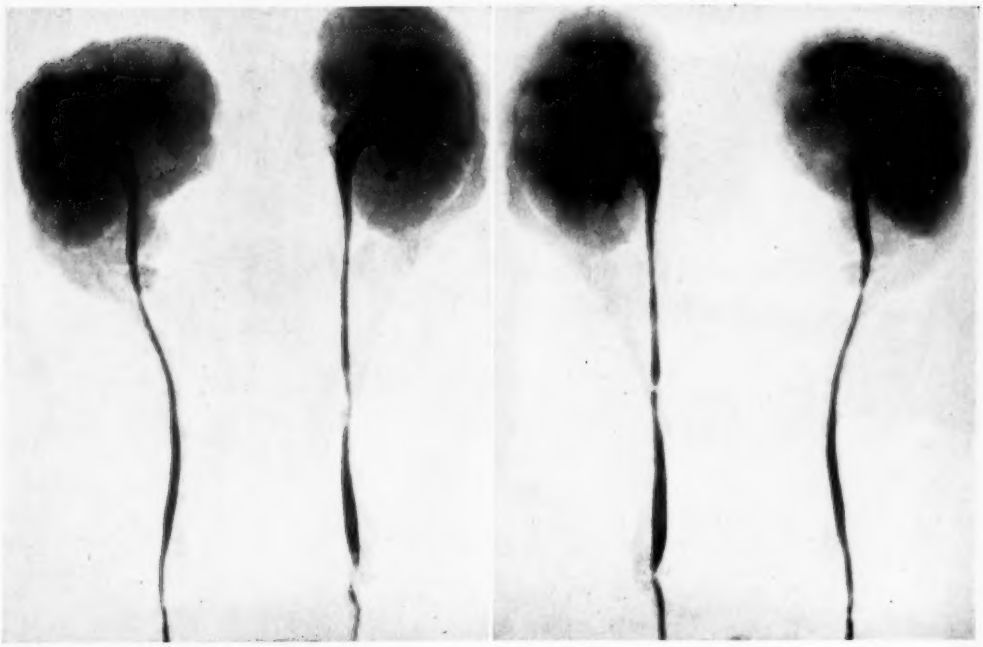

Fig. 8. Cadaver experiment to determine dilatability of adult human ureter. A. (left). Note upper and lower lumbar narrowings of left ureter. Only 10 cubic centimeters were injected before this film was exposed. B (right). Note how little change has taken place in contour of ureters when 20 cubic centimeters were injected. The opaque medium was forced into the renal parenchyma.

number of similar cases have been reported by others. I have recently had a seventh clinical case which I will cite briefly, and then add a follow-up report of the sixth case.

This latest case was a girl of 14 years suffering for a year from recurrent attacks of pain over the left kidney region, radiating along the course of the ureter. The attacks had recurred more frequently, and the severity of the pain had increased greatly before she was first seen with Dr. Carl Beck of this city. A distinct resistance to a No. 6 catheter was met in the upper third of the ureter, at the first examination. The ureteropyelogram (Fig. 10) revealed a distinct narrowing at the point of obstruction. At subsequent sittings we were able to introduce a No. 7 bougie through the strictured area in the lumbar region, and a little later a No. 8 F bougie, but a No. 9 could never be passed.

She had a slight recurrence of pain about 4 weeks after a No. 8 had been introduced, but has been free from pain now for over 4 months.

In the case of the little girl of 6, previously reported, we have been informed that with the exception of one slight attack of pain in the summer of 1924, there has been no recurrence since the series of dilatations (given in December, 1923) of the stricture at the vesical outlet of the ureter.

It is not my contention that every stricture encountered in adult life is of congenital origin, but I believe that the number is far greater than Hunner, Caulk, and others have been willing to grant.

Now in regard to the second question, viz.: "Do we overlook strictures as often as Hunner claims, or are his own methods of examination open to criticism?"

Before discussing these two aspects, let me say that no one appreciates more highly than the writer that Hunner's work has been invaluable in directing our attention to a clinical

Fig. 9 (left). Ureteropyelogram of case of inflammatory dilatation of the ureter and renal pelvis.
Fig. 10. Ureteropyelogram made of a girl of 14, with stricture of the upper portion of the lumbar (left) ureter to which arrow points (see text).

entity of which many experienced urologists even today deny the existence. I also have the highest admiration for the integrity and perseverance of the chief protagonist of the frequency of ureteral strictures. It is necessary, however, for us to have an open mind, to look at the question in a judicial manner, and to ascertain whether the evidence justifies the "verdict" that ureteral strictures occur as frequently as is maintained.

First of all we must be thoroughly familiar with the normal ureter, as described at the beginning of this article, and second our methods of examination must be above criticism.

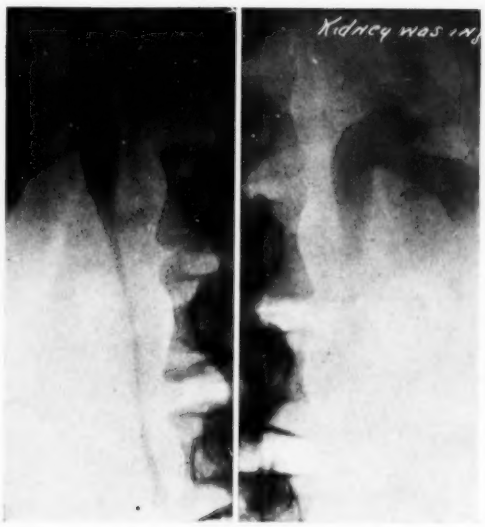

Fig. 11. At left, ureteropyelogram from case of stricture of lumbar portion of right ureter, following blow over right upper quadrant of abdomen. Note narrowing of shadow of ureter below kidney. At right, same case. Exposure made 1 hour after injection of opaque medium. Note retention proximal to strictured area.

I am of the opinion from personal observation of Dr. Hunner's work and an unbiased study of a relatively large percentage of cases, that the so-called "hang" test is not above dispute. If one watches, through an operating cystoscope, the wax bulb during its withdrawal, one will see that the "hang" is obtained at a point where the ureter is normally very narrow, i.e., at the vesical outlet. Again the angle formed by the juxtavesical and intraparietal portions of the ureter will lead us astray unless we bear it in mind in withdrawing the bulb. The use of solid bougies of varying sizes in determining the caliber of the different levels of the ureter is more accurate than any other method.

Because of the possibility of being deceived when the bulb bougies are employed, it is open to question whether the examination for the presence of ureteral strictures should not be limited to the ureteral bougie, plus ureteropyelography. As Rathbun has recently pointed out, this latter method should be carried out by first filling the renal pelvis and then making one exposure. A little more

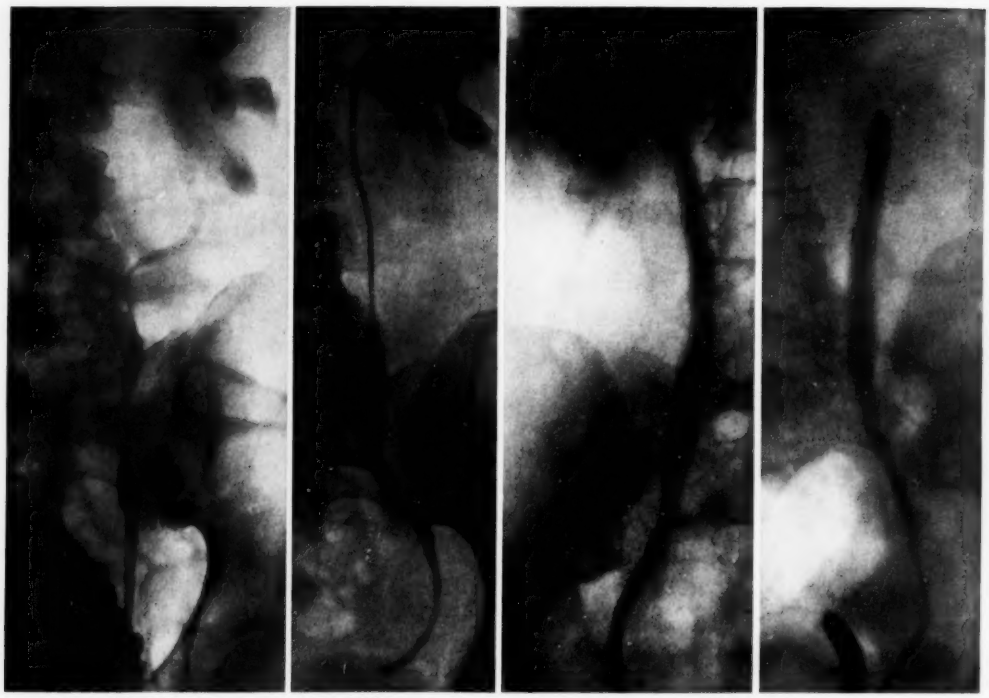

Fig. 12. Fig. 13. Fig. 14.

Fig. 12. Ureteropyelogram made of a case of tabes, with left-sided reflux. Note alternate wider and narrow areas in lower ureter, probably due to localized muscular spasm.

Fig. 13. Ureteropyelograms made of a case of recurrent upper abdominal pain (right-sided) due to stricture in lumbar portion of the ureter. Note dilated renal pelvis and calyces; also the dilatation of ureter distal to stricture, due to pressure of injected fluid.

Fig. 14. A (left). Dilatation proximal to stricture in the pelvic portion of the ureter. B (right). Dilatation of stump persisted and caused pain after nephrectomy.

of the opaque medium should then be injected until the catheter has been completely withdrawn, and then a second film exposed.

If one desires to ascertain the degree of obstruction by the length of time the fluid is retained in the ureter and renal pelvis, a third and fourth film taken at intervals of 15 and 30 minutes after the first film is exposed, will often reveal retention of the opaque medium. This was well shown in a recent case (Fig. 11).

One should exercise great care in interpreting the ureteropyelogram so that (1) an inflammatory dilatation (Fig. 9) may not be mistaken for a mechanical one; i.e., proximal to a stricture; (2) a localized spasm may not be interpreted (Fig. 12) as a constriction; and last, but not least, one must be familiar with and bear in mind the great variation occurring in ureteropyelograms of normal individuals (Fig. 4).

In view of the cadaver experiment cited earlier in this paper, we feel fairly confident that when increased pressure and more of the opaque medium are employed, the normal ureter will not dilate enough to result in widening the ureteral shadow. Dr. Arens and the writer will, however, continue their experiments on this question. There is, we believe, a middle ground between the frequency of stricture of the ureter, as maintained by Hunner and others of his more enthusiastic supporters, and that of the attitude taken by those who absolutely deny the existence of such a pathological and clinical condition. It reminds one somewhat

Fig. 15. Fig. 16, A. Fig. 16, B.

Fig. 15. Typical location of kink in cases of abnormally movable kidneys. Note dilated calyces.

Fig. 16. A (left). Ureteropyelogram showing both a kink in the upper third of the ureter and a stricture at the ureteropelvic junction with resultant renal infection. B (right). Ureteropyelogram made of a case of stricture at ureteropelvic junction with marked dilatation of renal pelvis and calyces.

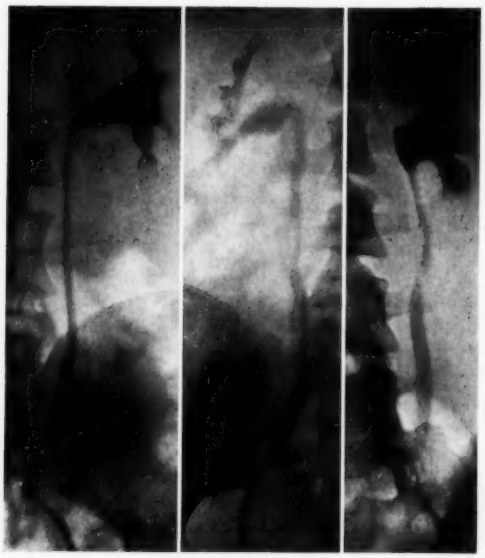

Fig. 17. Various examples of abnormal ureteral inserts. A (left). From girl of 20. Chief complaint, recurrent pain over right kidney. Not operated upon. B. From man of 25. Similar clinical history and findings as in A. Not operated on. C. From woman of 30. Persistent right-sided abdominal pain. No relief from appendectomy some years before. Pelvis dilated but little change in calyces. Not operated upon.

of the early history of duodenal ulcer when those who opposed the idea that it was a frequent clinical finding based their argument upon the rarity of its occurrence at autopsy as pointed out by Rokitansky.

Improved diagnostic technique and study of the living tissue (at the operating table) has convinced everyone, however, that duodenal ulcer is far more common than was formerly thought, and it must be excluded in every case with upper abdominal symptoms.

Hunner, Rathbun, and others have rendered an invaluable service in their pioneer work. Those who, like myself, have maintained a spirit of impartiality toward the question, are convinced of the far more frequent occurrence of ureteral stricture than was formerly thought to be the case.

The search for the cause of abdominal pain must, therefore, at the present time, include an examination of the ureter for stricture, preferably at a second sitting after all of the data except this has been obtained. It is not always an easy task to secure all of the desired information at the first sitting, in our experience, because so much time is consumed in collecting urine at each examination, making functional tests, etc., that it is often advisable either to look for stricture alone at the first sitting and to complete the urological study at a second, or to reverse the order.

During the past 3 years I have found in patients of all ages strictures when least suspected, by keeping their possible presence in mind in cases of abdominal pain of obscure origin, in recurrent ureteral colics or calculus formation, in hæmaturia, and in persistent pyelitis. In these cases the improvement obtained after dilatation combined with pelvic lavage ought to convince anyone with an open mind that he who overlooks the occurrence of ureteral stricture is neglectful of his duty toward the patient.

URETERAL KINKS

The same position which we have urged taking toward strictures must be our guide in this comparatively new clinical entity. That kinks are often found upon inspection of a normal ureteropyelogram (Fig. 6) can no longer be denied by those who claim that every kink must be followed by symptoms due to its presence.

Our ability to demonstrate the kink as the first step in the production of Dietl's crises in abnormally movable kidney (Fig. 15) is also a development of the subject of kinks. Redundancy of the ureter (Fig. 6) will account for many of the reduplications seen in patients without symptoms or other findings than the ureteropyelogram. As in ureteral stricture, there are no doubt cases in which the kink plays an important part in the production of abdominal pain, recurrent colics, persistent pyelitis, etc. Hence, it should not always be regarded as an accidental finding. Its presence in the ureteropyelogram should be carefully considered in conjunction with the other urological findings as well as the clinical history. It can be artificially produced by making only one exposure (Fig. 7) while the tip of the opaque catheter is still at a relatively high level in the ureter. It is advisable, as in the case of ureteral strictures, to withdraw the catheter completely before a second exposure is made. In order to ascertain the rôle the kink plays in the production of renal pelvic retention, it might be well, in doubtful cases, to make a third exposure at the end of a half hour.

In the case shown in A of Figure 16, the patient's chief complaint was abdominal pain. The urological study revealed an infection of the right kidney, with inflammatory dilatation of the ureter and renal pelvis, and a well marked kink, which we considered to be the chief factor in causing obstruction to the proper emptying of the renal pelvis.

Further inspection of the ureteropyelogram (Fig. 16) reveals a second factor in the shape of a stricture at the ureteropelvic junction.

In the case shown in B of Figure 16, the pelvic retention and accompanying infection was due to a stricture at the ureteropelvic junction alone. I have placed these two ureteropyelograms side by side because in one case there were two adjacent causes of obstruction, viz., a kink and a stricture; while in the other there was no kink and only a stricture. These findings emphasize the necessity of routine ureteropyelography in all cases of renal infection as soon as acute symptoms have subsided.

The point which I wish to make in connection with ureteral kinks is that one should not draw the deduction that when a kink is seen in the ureteropyelogram, it is necessarily responsible for all of the symptoms. If, however, we have evidences of renal infection clinically, and these are confirmed by the urological study of the case, it is justifiable to state that the kink is responsible for the obstruction to the escape of the pelvic contents.

ABNORMAL URETERAL INSERTS

Under normal conditions the ureter arises from the most dependent portion of the renal pelvis (Fig. 4). The advantage of this form of ureteropelvic junction from the standpoint of drainage is self evident. Although the renal pelvis is simply an expansion of the cephalic end of the embryonic ureter, a faulty development may take place so that the ureter joins the pelvis at a higher point. This anomaly has been known for years, and a fairly large number of plastic operations have been done to correct it.

My only object in bringing this anomaly before you is to direct attention to the possibility of recognizing it before operation through the aid of ureteropyelography. In three recent cases the chief complaint was recurrent pain over the kidney or one of the upper abdominal quadrants.

In all of the ureteropyelograms (Fig. 17) one can observe that the ureter passes either in front of, or behind, the lowermost point of the renal pelvis, before entering the latter. The knowledge of the existence of such an anomaly is not only of great value from a diagnostic standpoint, but also from that of treatment. Some form of plastic operation should be advised at an early stage, before pathological changes due to infection endanger the success of such a procedure.

FRACTIONAL LIGATION OF THE COMMON CAROTID ARTERY IN THE TREATMENT OF PULSATING EXOPHTHALMOS[1]

By HARRY H. KERR, M.D., C.M., F.A.C.S., Washington, D. C.

An exhaustive contribution to the subject of intracranial arteriovenous aneurism, or pulsating exophthalmos has been made by Charles Edward Locke of San Francisco, in the *Annals of Surgery* for July and August, 1924. In this excellent article he reviews the history and summarizes previously reported cases. He contributes 3 additional cases, bringing the total number reported in the literature up to 588.

In Locke's analysis of the results of treatment he comes to the following conclusions: "Carotid compression should precede any form of surgical intervention, and the type of intervention should depend upon the results of these tests. If prolonged periods of carotid compression stop the bruit and do not cause signs of cerebral anæmia, beneficial therapeutic results are to be expected from ligation. If the carotid compression test shuts off the bruit, yet gives headache or motor or sensory signs on the opposite side, a thorough course of compression is indicated before surgical intervention. If the carotid compression neither shuts off the bruit nor causes signs of brain anæmia, then a prolonged course of compression will not be of much value. Carotid ligation is indicated, but the surgeon will not be very confident of success."

In discussing the value of the various forms of surgical treatment he shows that the comparative results of common carotid and internal carotid ligation are about the same. Internal carotid ligation has been more frequently used of late; while the method of common carotid ligation extends back to the pre-antiseptic days.

I am reporting my 3 cases because they were all treated by common carotid ligation; they were all treated by an original method of fractional ligation; and they have all given as good results as could be expected.

The lesion in pulsating exophthalmos is an arteriovenous fistula between the internal carotid artery and the cavernous sinus. This is most commonly the result of a fracture of the base of the skull. The fracture line passing through the anterior fossa tears the artery in its course within the sinus. The first of my 3 cases is of this type. A fewer number of pulsating exophthalmos cases develop spontaneously, probably from rupture of an aneurism of the carotid into the sinus. Aneurism of the ophthalmic artery within the orbit without rupture may produce pulsating exophthalmos. The third case of my series was spontaneous in origin. A much smaller number are produced by direct violence, as from a gunshot wound. The second case in this series is of this type.

The natural history of pulsating exophthalmos leads eventually to complete blindness of the eye of the affected side. Not infrequently, however, the sufferers will commit suicide before this has occurred. The constant, uncontrollable reiteration of the bruit, from which they cannot escape, leads them to take their own lives. It is the bruit from which they seek relief.

The pulsation may be controlled by ligation of the afferent artery or of the efferent vein. The former method, however, is much the best, and may be accomplished by ligation of the internal carotid or the common carotid artery.

The question of the relative value of these two procedures depends upon two factors: the distance of the ligature from the lesion and the collateral circulation. Though ligation of the internal carotid does occlude the afferent current somewhat closer to the fistula, the difference between that and ligation of the common carotid artery is so slight that it can be dismissed. The principal collateral circulation of the affected artery, the internal carotid, is through its branches, the arteria receptaculi, and the anterior communicating artery which links it with its fellow of the opposite side in the formation of the circle of Willis.

[1] Read before the Southern Surgical Association, December, 1924.

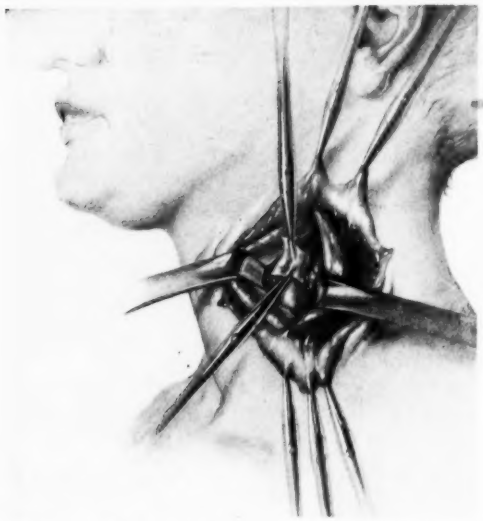

Fig. 1. Strip of fascia lata placed around common carotid artery.

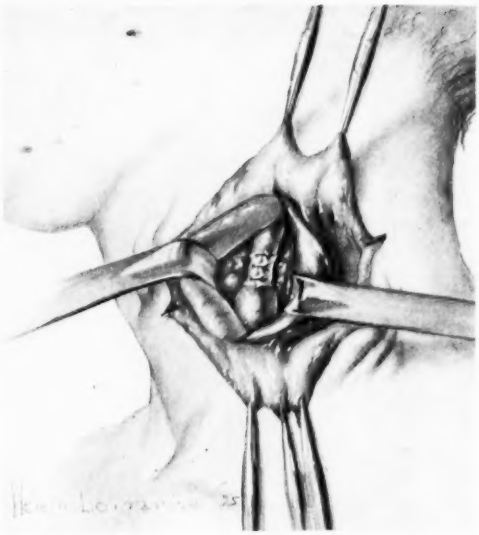

Fig. 2. The fascia lata sutured in place to maintain a 50 per cent occlusion.

The former collateral circulation depends upon a free anastomosis between its branches, the arteria receptaculi, and the middle meningeal branch of the external carotid artery of the same side. A collateral circulation reestablished through this channel would pour arterial blood into the internal carotid at, or near, the lesion itself, and would, therefore, be more likely to give unsatisfactory results or lead to a recurrence than if this collateral circulation did not exist.

The other important collateral circulation through the anterior communicating artery, is distal to the lesion, and though there may develop some reversion of the circulation in the lesion, it is unlikely that it would be of great moment.

I therefore feel that there is a definite advantage in common carotid ligation, which not only occludes the affected vessel but also the vessel from which an anastomosis might bring recurrence. The danger of common carotid ligation lies in the possible embarrassment of the cerebral circulation of that side. This complication is escaped or avoided through the collateral circulation by way of the anterior communicating or vertebral arteries. Ligation of the common carotid does not interfere with this collateral. It is necessary, however, that the collateral cerebral circulation be given a chance to develop. This is best accomplished by my operation of fractional occlusion.

When my first case was referred to me by Dr. Edw. L. Morrison, on May 27, 1917, a review of the literature at that time seemed to indicate that ligation of the common carotid was more sure in its results than internal carotid ligation. However, the danger of cerebral anæmia, with the possibility of a fatality or hemiphlegia, made it dangerous as a one stage procedure. In testing this patient by carotid compression I could produce symptoms of cerebral anæmia within a few seconds. By partial compression of the common carotid against the transverse process of the sixth cervical vertebra, I could stop the pulsation of the eyeball and cause the disappearance of the bruit subjectively. Objectively, however, with this partial compression, a bruit could be made out with the stethoscope. This partial compression did not produce any signs of cerebral anæmia, even when maintained for a considerable period of time. It therefore seemed advisable to occlude the vessel partially, but dangerous to ligate.

The patient was therefore operated on under local anæsthesia and a strip of fascia lata from the thigh was passed around the common carotid below the bifurcation. The artery was gradually constricted until the pulsation of the eyeball ceased, but not to a sufficient extent to produce signs of cerebral anæmia. The patient, being conscious, was able to

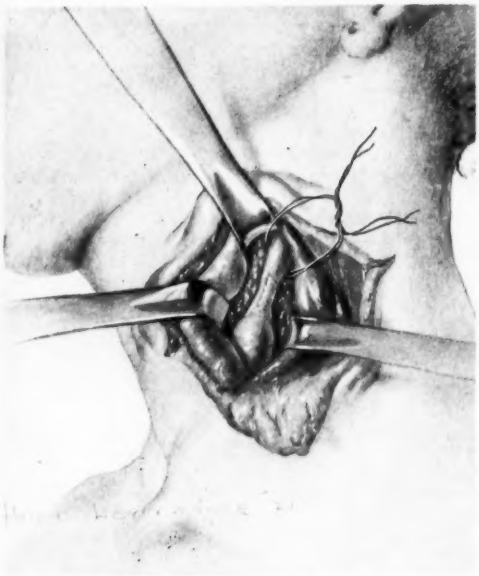

Fig. 3. Double ligature placed ready to completely occlude the artery above the fascial band.

co-operate in guiding us to a nice exactness of the extent of occlusion that could be made on the artery, short of serious symptoms. When this had been accomplished, the fascial band was sutured *in situ* with chromic catgut. It was found that the lumen of the artery had been reduced by about 50 per cent by the maneuver. The wound was then closed. The immediate results were gratifying in that the patient was not aware of the previous annoying bruit, though it could still be heard with the stethoscope.

The character of the bruit on objective examination was decidedly altered. Three days after operation, during the night and while lying on the affected side, the patient was first aware of the return of the roaring. No untoward symptoms developed. Three weeks later the vessel was again exposed through the former incision, and the common carotid artery ligated with a double ligature above the fascial band. The patient was discharged, entirely relieved of his previous annoying symptoms.

A letter from the patient 5 years later states that (1) the sight of the affected eye is as good as that of the other; (2) the movement of the eyeball is perfectly normal; (3) occasionally, following violent exercise there is pulsation of the eyeball to be seen; (4) the noise is never heard except when he is lying with the affected side on the pillow in the quiet of the night and following too much exercise; (5) he has never had any weakness or paræsthesia of the opposite side of the body.

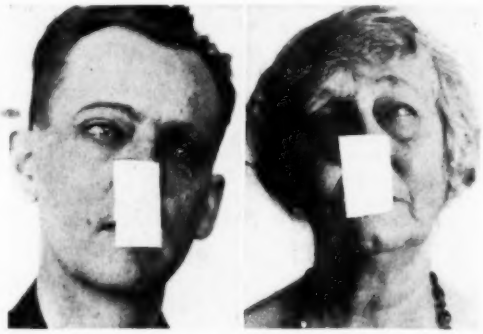

Fig. 4 (left). Photograph taken 2 years after operation of fractional ligation of common carotid artery for pulsating exophthalmos, showing an almost invisible scar at the level of the thyroid on the right side of the neck and the condition of the right eye.

Fig. 5. Case 3. Photograph taken 1 year after operation showing almost invisible scar on the left side of the neck and the condition of the left eye without exophthalmos and with perfect vision.

The second case was referred by Dr. William H. Wilmer, in March, 1923, with the history of having been shot with bird shot on the left side of the head and face the previous November. This accident destroyed the left eye, which was immediately enucleated. A bruit developed shortly thereafter, and then a pulsating exophthalmos of the remaining eye gradually developed.

Examination disclosed pulsation of the right eye and a bruit that was loud over the entire head and neck, but loudest over the cheek, and apparently of equal intensity on both sides. Motion of the eye was impaired in every direction except outward. The examination was otherwise negative. The sight in this eye was 20/20. An X-ray showed many scattered bird shot in the scalp and in the face. One shot was inside the cranium, at or very near the base of the sella turcica on the right side.

We were here confronted with a young man of 36 who had lost one eye and had developed a pulsating exophthalmos in the other eye. At this time the vision of the remaining eye had not been affected. Mindful of the satisfactory result obtained by fractional ligation in the first case, I carried out the same procedure in this patient. A strip of fascia lata was again passed around the common carotid artery and the vessel was constricted about one-half, under local anæsthesia. This maneuver completely obliterated the bruit, both objectively and subjectively.

Following this first operation the condition of the eye slowly improved. The bruit was changed to a high pitched, soft murmur heard only with a stethoscope. One week after operation, power developed in the internal rectus and possibly in the superior rectus. Two weeks after the first operation, under gas anæsthesia, the common carotid was doubly

ligated with Number 2 chromic catgut just above the fascial graft.

Examination 2 weeks after the second operation showed that the exophthalmos had disappeared with gradually returning power in the muscles. There was no pulsation over the eyeball. The bruit on auscultation could be made out faintly over the eye and opposite the external angular process, but it was not heard by the patient except faintly in the dead of night. It was so distant and faint subjectively that it was not appreciated in the presence of any other sound.

Seven months later, the bruit was about the same as after the operative procedure. It could be heard by the patient only when everything was profoundly still. All movements of the eyeball were normal. There was no pulsation felt or seen in the eyeball. Occlusion of the common carotid above the site of ligation did not affect the bruit, but occlusion of the opposite common carotid or opposite internal carotid stopped it completely. It was suggested to the patient that the internal carotid of the opposite side might be ligated to effect a complete cure, but he stated that the function of the eye was perfect and the bruit was so seldom heard that it was of no consequence, and he saw no reason for further operative procedure.

Both of these cases were of traumatic origin, the first from a fracture of the base of the skull, and the second from the result of a gunshot accident.

My third case was in a woman 72 years of age, and was probably of spontaneous etiology. She was referred to me by Dr. Wilmer, May, 1924. She gave a history of a fall 18 months before, from which she was not rendered unconscious, but from which she had some bleeding from the nose and severe headache. There was a prompt recovery. Six months after this, while walking on the street, she had a sensation of a sudden brilliant shaft of light above her eyes. She was made dizzy and nauseated. A similar attack occurred one week later. Three months later she first noticed a roaring in her ears. This persisted and grew gradually worse. She developed a pulsating exophthalmos, one month after. She had been under Dr. Wilmer's care and had had digital compression and confinement to bed for about two weeks. There had been some improvement but not enough to promise any results. Her blood pressure ranged around 200.

The question of operation was discussed and finally resorted to. A primary operation was performed May 26, 1924, under local anæsthesia. The common carotid artery was found extremely large and its lumen was reduced about 50 per cent with a band of fascia lata from the thigh. This amount of occlusion was sufficient to stop the bruit both subjectively and objectively, but gave no cerebral signs. The wound was closed without drainage.

The bruit returned objectively, but not subjectively, a few days after operation. On the fifth day she was again conscious of the murmur when no other sound was audible. Three weeks after the first operation a definite pulsation in the eye returned. The roaring had increased somewhat. Complete digital occlusion of the common carotid produced a complaint of dizziness after 15 seconds, but after 45 seconds there was no advance of this symptom. In view of a blood pressure of 200 and arteriosclerosis, it was thought wise to postpone further interference until a more satisfactory collateral circulation was established.

Under local anæsthesia the artery was again exposed on June 20, 1924, and doubly ligated with chromic catgut. This produced no subjective symptoms. Speech was not affected. There was no numbness or tingling of the right hand, and there was perfect control of that extremity. The bruit disappeared subjectively, but could still be faintly heard with the stethoscope. Four days after operation the patient developed a little thickness of speech and mental confusion. At this time the bruit, which had been faintly heard over the left temple with the stethoscope, entirely disappeared. There were no changes of the reflexes or the muscular power on either side. Sensation on the right side was unimpaired. The slight aphasia gradually improved.

On July 11, on careful examination, the previous bruit heard over the left eye and temple had disappeared, but a soft murmur could be made out under the left mastoid region. The patient was not aware of this noise. No pulsation in this region could be elicited, and no swelling or mass could be felt. The murmur was not louder near the site of ligation than at the point of maximum intensity. The condition of the eyes was normal, and sight was perfect. The possibility of her having developed another aneurism in the vessels of the neck was considered, as the new murmur was evidently not from her previous arteriovenous fistula.

A letter received 6 months after operation states that the condition of her eye is perfect. There is no pulsation, but the patient is aware of a soft, blowing murmur, which is evidently the bruit which has developed since operation.

A STUDY OF MENSTRUATION

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IN all studies of menstruation, the search has been in regard to the more direct manifestations of the condition and the more obvious expression of alteration of the body processes. Inasmuch as all functions of the body are under control of the vegetative nervous system in one way or another, it is interesting to consider the effect of menstruation upon the autonomic or sympathetic nervous system which controls the functions of the heart, the intestines, the respiration, etc.

In the smooth muscle of the stomach and intestines as viewed through the fluoroscope and recorded by radiographs, is a sensitive and mobile mechanism which readily registers the action and condition of the vegetative part of the human organism and is a manifestation of the action of the vegetative or autonomic nervous system, the vagus and sympathetic nerve apparatus. The vagus and its branches stimulate the muscles and motor mechanism of the stomach to action and inhibit the sphincters. The sympathetic and its branches inhibit the smooth muscles of the stomach and intestines and stimulate the sphincters. Here in the delicate reactions of this large expanse of smooth muscle, as viewed by the X-ray after a barium sulphate meal, is the best opportunity to record the condition of the vegetative part of the human organism and the condition of the autonomic nerve supply in the movements and arrangement of the smooth or nonstriated muscle of the digestive tract. It is the largest unit of smooth muscle in the body so it is also most capable of movement and alteration. We have called these manifestations and phenomena, the *smooth muscle reaction*. In the course of a much larger study of many and varied conditions, we have found that definite alteration in the haustra and arrangement of the intestines occurs as a result of vagus or sympathetic action or the preponderance of one or the other; and a great number of examinations have been made to prove that these effects were constant under similar conditions of colloid and mineral metabolism and that they were not the result of mechanical filling of the intestine or other accidental circumstances. We have made experiments to prove that this alteration in the intestinal arrangement is the result of nerve action and that this action depends upon the vagus and sympathetic branches of the vegetative (autonomic or

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1. Normal intermenstrual smooth muscle reaction of the colon, showing 20-hour barium meal with normal haustra and normal innervation. Figures 1 to 3 are of the same patient.

Fig. 2. Intermenstrual smooth muscle reaction of the colon with vagus preponderance.

Fig. 3. Postmenstrual smooth muscle reaction of the colon returning to intermenstrual condition.

Fig. 4 (left). Intermenstrual smooth muscle reaction of the colon, showing some vagus preponderance in the innervation.
Fig. 5. Menstrual smooth muscle reaction showing marked vagus preponderance.
Figures 4 and 5 are of the same patient.

sympathetic) nervous system. We have also made experiments in regard to the ingestion and injection of various salts of calcium, potassium, sodium, and magnesium, to show the effect of alteration in the mineral metabolism upon the arrangement of the intestine which is believed by us to be an expression of the action of the vegetative nervous system. We have also found that the hydrogen ion concentration of the blood bears a direct relation to the smooth muscle reaction. These results will be published *in extenso* in another place, but we wish to report here the results as far as concerns menstruation.

The smooth muscle reaction is, we believe, an expression of the metabolism and constituent acid base and salt balance of the fluids of the body and this expression is produced through the respective action of the vagus and sympathetic nerve branches of the vegetative or autonomic nervous systems. Our examinations were made under uniform conditions of time, size, and temperature of barium meal, absence of drugs, etc.

There are many evidences to prove that menstruation is a time of metabolic alteration. The pain and mental disturbance are familiar. There is a rise in blood pressure before the menstrual flow and this drops during the flow to return to normal about 2 to 4 days after its cessation. The premenstrual rise of temperature corresponds to the increased activity of the body processes. The blood picture in menstruation has been studied by Gumprich (1), Nessmelova (5), and Palzl (6). The results of these studies show that there are four phases of the blood picture: the normal or intermenstrual lasting an average of 13 days, the premenstrual about 6 to 7 days, and the menstrual and postmenstrual each lasting about 4 days. On an average there is an increase in the red cell count of 188,000 before the beginning of menstruation. During menstruation, the red blood cells are slightly decreased from normal. At the beginning of the postmenstrual period, the number increases again, then gradually falls until it reaches the intermenstrual period. The leucocytes are lowest during menstruation, with a decrease in the polymorphonuclears. The basal metabolism progressively increases until just before menstruation when it is diminished.

A menstrual toxin has been studied by Macht and Lubin (3) who showed that the secretions, saliva, sweat, and urine of a menstruating woman had an evil effect upon the growth of certain seedlings. Other investigators have studied the effect of menstrual blood serum, as Labbardt and Hussey (2) who found that, compared with normal serum, menstrual serum had a stimulating effect upon smooth muscle and a vasoconstrictor effect upon perfused blood vessels.

From this review, it may be seen that menstruation is a time of considerable metabolic disturbance and that there is a menstrual wave which begins about 7 days before menstruation and that it is accompanied by changes in the organs which can be recorded by methods of accuracy. Blair Bell believes that menstruation is dependent to a very con-

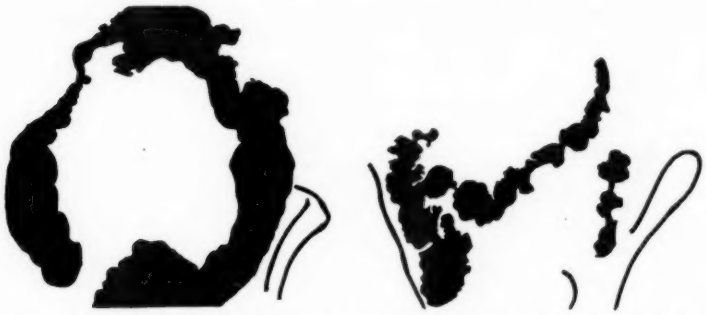

Fig. 6 (left). Intermenstrual smooth muscle reaction of the colon in a case of dementia præcox.

Fig. 7. Menstrual smooth muscle reaction of the colon in this case of dementia præcox which was very much excited and worse at menstruation. Figures 6 and 7 are of the same patient.

siderable degree upon the presence of calcium in the blood and he found that the menstrual blood contained considerably more calcium than the circulating blood. We have also been able to produce in certain cases, changes in the haustra and arrangement of the intestine similar to the condition of the intestine at menstruation by the ingestion and venous injection of various calcium salts. Blair Bell's methods of calcium estimation may be rather questionable as to accuracy, but his conclusions as to the increase in calcium effect are in our opinion sound. Heape also came to the same conclusion in regard to the calcium wave. In a study of the calcium content of blood, Malamud (4) examined the blood of 20 women through two or three menstrual cycles. He used the ash method and this may be taken as accurate. He found that there was a tendency of the calcium content to rise in 57 per cent of cases and in only 14 per cent did the calcium drop.

We studied menstruation in the most normally menstruating women we could find. The result of our investigation, although carried over several months, may be seen in Figures 1, 2, and 3. The illustrations here are made from thin paper tracings of the X-ray plate in the viewing box and so are accurate as to scale and detail. The condition of the smooth muscle reaction may be seen in Figure 1, 8 days before menstruation. At this time, the innervation was normal and inclined (indeed) toward sympatheticotonia. The intestine was large and well placed and showed no stigmata of degeneration. The condition at menstruation is shown in Figure 2, where the intestine had become smaller, the haustra irregular and there was evidence of a preponderance of the stimulation of the vagus. This condition disappeared 5 days after menstruation (Fig. 3), and at that time the character of the smooth muscle reaction was again approaching normal.

A somewhat similar condition is shown in another patient who did not menstruate as normally as the first. This patient had greater evidences of toxæmia and a very profuse flow which lasted 4 days. She was subject to considerable disturbance at the time of her menstruation with acetone on her breath and in the urine and considerable yellowing of the skin in the last day of menstruation and afterward. In her intermenstrual period, the condition of the smooth muscle reaction, as shown in Figure 4, was that of somewhat upset innervation with a tendency toward preponderance of the vagus influence. This was shown by the caliber of the intestine, the irregular arrangement of the haustra and the rate and rhythm of the smooth muscle. The condition of the smooth muscle reaction one day after menstruation is seen in Figure 5, where there is marked narrowing of the lumen and a much greater irregularity of the haustra.

The condition of another patient is seen in Figures 6 and 7. This patient had dementia præcox and was subject to considerable ex-

acerbation of her condition at menstruation. She showed marked preponderance of the vagus influence during menstruation.

These illustrations are chosen from a considerable number and illustrate our belief that menstruation is a time of vagus preponderance and that this alteration can be seen and recorded in the smooth muscle reaction of the intestine. This is not surprising as the uterine muscle is supplied by the vegetative nervous system and any stimulation of the uterine muscle is quite likely to be associated with stimulation of the adjacent smooth muscle of the intestine, associated with the same nerve supply. The longitudinal muscle of the uterus is stimulated by the vagus and inhibited by the sympathetic. The circular muscle is stimulated by the sympathetic and inhibited by the vagus. The intestine and heart react toward the same nerve influence, so it is not surprising that the uterus and intestine react similarly.

Indeed, it is quite possible that the preliminary cramps and pains of menstruation may be, in some part, due to intestinal cramps from vagus influence and that the constipation, so often associated with menstruation, is a spastic constipation due to contraction of the colon from stimulation of the pelvis branch of the vagus.

According to the law of summation of impulses, there must be a considerable number of contractions of a hollow organ before pain results and this may explain the varying amount of pain at menstruation. For example, a slight induction shock to the skin that is not intense enough to cause any pain, becomes unbearable by summation, so the pain of smooth muscle or uterine muscle is due to contractions of a hollow organ, the stimulus of which may be only enough to cause contractions, but, with summation, is translated as pain or cramps.

One of us has been somewhat successful in lessening the pain of dysmenorrhœa by the use of drugs and salts which inhibit the vagus or stimulate the sympathetic in order to lessen the vagus preponderance. The action of atropine, for example, is well known as decreasing the pains of menstruation. Atropine paralyzes the vagus and, in this way, reduces the vagus preponderance. We have made experiments which show the action of atropine upon the smooth muscle and its arrangement. Similarly drugs and salts which stimulate the vagus increase menstrual pain and flow. We hope to make the therapeutic results the subject of further study.

From the present study our conclusions are that menstruation is a time of vagotonia or vagus stimulation and that this can be shown in the smooth muscle reaction of the intestine as pictured by the X-ray. The wave of vagus preponderance begins from 8 to 2 days before menstruation, reaches its height during menstruation and returns to the intermenstrual condition from 3 to 6 days after menstruation. There is some evidence that among other factors this vagus preponderance is, in part, at least, due to the accumulation of calcium in the blood and tissues and that calcium is cast off at the time of menstruation. It is possible that some of the preliminary pains of menstruation are due to intestinal cramps from vagus stimulation. Drugs and salts which reduce the vagus stimulation relieve the menstrual pain.

REFERENCES

1. Gumprich. Beitr. z. Geburtsh. u. Gynaek., 1913–1914, xix, 433.
2. Labbardt and Hussey. Ztschr. f. Geburtsh. u. Gynaek., 1922, lxxxiv, 715.
3. Macht and Lubin. J. Pharmacol. & Exper. Therap., 1924, January.
4. Malamud. Comp. rend. Soc. de biol., Par., 1924, June 13.
5. Nessmelova. Inaugural Dissertation, Tomax, 1913.
6. Palzl, Anna. Med. klin. Wchnschr., 1910, xxiii, 238.

THE BRONCHOSCOPIC TREATMENT OF LUNG ABSCESS

By MERVIN C. MYERSON, M.D., New York

LUNG abscess is without doubt more prevalent today than in former years. Perhaps this is at least in part due to the increased number of tonsillectomies which seem to hold a prominent place in the etiology of this distressing condition. It might also be that a good many of our cases that were labeled chronic pulmonary tuberculosis are being properly classified as lung abscess. Further, the lung changes caused by the severe influenza epidemics must have some bearing upon the etiology of these conditions. Certain it is that lung abscess is better understood than it was a decade ago. It is a well recognized condition with a definite symptomatology and with a fairly well understood pathology. Although the major etiological factors are fairly well known, the mechanism of the production of these lesions is poorly understood. Work such as is being done by Mason (7), and Fetterolf and Fox (2), should help toward a better understanding of the etiology in at least some of the postoperative cases.

The general interest in lung abscess dates back to 1912 when Richardson (13) first reported lung abscess following tonsillectomy. On this subject he was followed by Bassim (1) in 1913, Manges (6) in 1916, and numerous others since. Stress is laid upon the relative frequency of pulmonary complications following operations upon the upper air passages. Lord (4) reports 98 of 227 cases of lung abscess as due to operations upon the upper air passages; Whittemore (14) 66 of 100 cases; Mackenzie (5), 11 of 67; in Hedblom's (3) series of 692 cases, 146, 21 per cent, were postoperative, while of these 48 followed tonsillectomy. Of 96 abscesses seen by the writer 16 followed tonsillectomy, and 1 followed operation upon the jaw. In a statistical study, Moore (8) reported 202 lung abscesses occurring in approximately 450,000 tonsillectomies, an incidence of about 1 in 2,500.

Lung suppuration may be produced in one of several ways according to our present conceptions: by aspiration, by means of the blood stream, by extension from neighboring structures, and by trauma to the chest wall or the thoracic viscera. A fifth manner of production of lung abscess might be the suppuration which follows the condition recognized as unresolved pneumonia.

The frequency of the tonsil operation and the consequent interest in lung abscess following this operation, justifies at least passing comment on the probable mode of production of the abscess in these cases. In the discussion of post-tonsillectomy abscess, aspiration and embolism are the modes of production which require consideration. Both routes of infection have their advocates. As a result of his bronchoscopic studies (9 and 10) of tonsillectomy under general anæsthesia and because of his interest in the care and treatment of these lung abscess cases, the writer has been led to favor aspiration (11) as the principal route of infection in post-tonsillectomy suppurations.

About 10 years ago, Yankauer began to irrigate lung abscesses with the special cannula which he then devised; shortly afterward, Lynah popularized this treatment. More recently Jackson and his associates have taken up this work.

A review of 32 cases of lung abscess which were treated systematically by the writer is here given. This does not include some 60 or more cases with which he came in contact on the various services of the Kings County Hospital and the other institutions the material of which was available to him. These cases were almost all subjected to bronchoscopy but not systematically treated and are therefore not included in this review.

A glance at Table I shows the variety of etiological factors which we encounter in these cases. It also demonstrates that many cases are designated as pneumonia when the true etiological condition is not known.

The ages range from 3 to 55 years. The duration of the disease has been found to be from 2 weeks to 14 years.

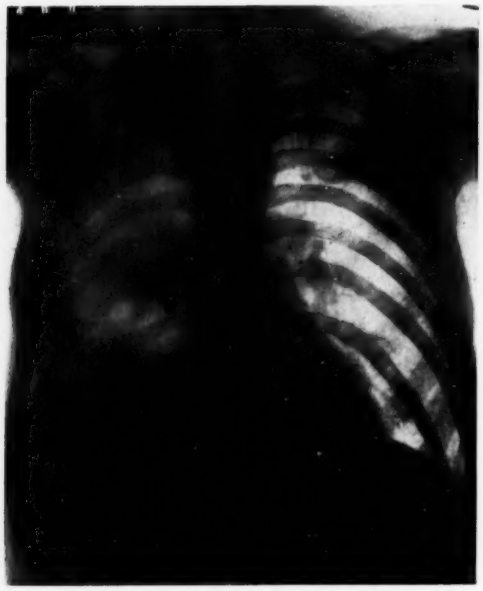

Fig. 1. H. N., male, age 38, abscess, right lower lobe, following pneumonia.

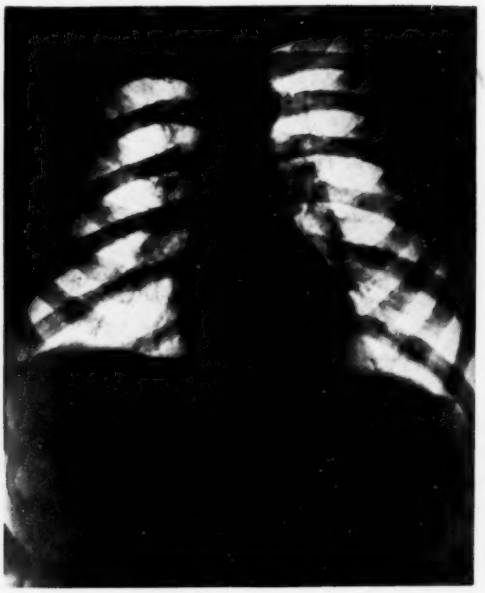

Fig. 2. H. N., same patient, 4 months after last bronchoscopic treatment.

TABLE I.—ETIOLOGY AND RESULTS OF TREATMENT

		Cured	Improved	Unimproved	Died
Pneumonia	9	2	7*		
Tonsillectomy	6	3	3		
Influenza	2	1	1		
Fractured rib	1		1		
Foreign body	2	1			1†
Jaw—ether	1		1		
Appendectomy	1			1	
Carcinoma—ether	1			1	
Fractured femur	2		1	1	
Amputation	1		1		
Broncho-pneumonia	1		1		
Diverticulum	1		1		
Obscure	4		2	1	1‡

*One patient prepared for operation; surgical cure.
†Child, multiple papillomata of larynx, intubation tube allowed to fall into right bronchus (mistaken diagnosis diphtheria), abscess right middle and lower lobes. Tracheotomy. Duration 3 years.
‡Age 17, duration 14 years, entire left side, surgery refused.

TABLE II.—LOBES INVOLVED

Right		Left	
Upper	3	Upper	6
Middle	1	Lower	5
Lower	14		
Middle and lower	1	Both lobes	2
	19		13

The incidence of lower lobe involvement is greatest, and the right side shows a higher incidence than the left (Table II).

The number of bronchoscopies in a given case is of no special significance, because there are many factors that influence results. These depend not only upon the pathology and treatment indicated, but also upon the disposition and co-operation of the patient and frequently of his family. Patience and endurance on the part of both the bronchoscopist and those concerned in the treatment is essential. Figures and percentages mean very little in the consideration of these distressing conditions. The fact that a patient is reported as improved does not mean that he cannot develop an acute exacerbation of his chronic condition and die in a very short time, of toxæmia. The true effect of any given treatment is to be measured by a conception of the local pathological process.

The treatment of suppurative lung disease resolves itself into expectant and non-expectant.

The expectant consists of posture, antituberculosis régime, and vaccines.

Fig. 3. H. G., male, age 40, abscess right lower lobe, following ether operation upon jaw. Roentgenogram shows mapping of abscess area after method of Lynah, by the use of bismuth and oil.

Fig. 4. T. K., male, age 4, post-tonsillectomy abscess right lower lobe.

The non-expectant consists of bronchoscopy, artificial pneumothorax, and surgery—(1) collapse and (2) removal. Of the non-expectant types of treatment bronchoscopy in the hands of the qualified worker is the safest, the least uncomfortable, and the simplest form of treatment.

There are roughly two classes of suppurations which come for treatment: the acute and chronic cases. In the acute cases, it has been the writer's experience that a cure can be obtained with the bronchoscope. In the chronic cases alleviation of symptoms and improvement is usually the case, but cure has not been encountered thus far. Therefore I have come to regard these cases as cures and non-cures. Let us for the moment consider how bronchoscopy aims to accomplish a cure in the acute cases.

Bronchoscopy aims to establish a cure in the following manner: In the first stage through (1) aeration, (2) irrigation—thinning of secretions, and (3) aspiration—evacuation. Nature does the rest. In the second stage through (1) collapse and obliteration of cavity, and (2) through replacement fibrosis.

The second stage is cared for purely by nature's handiwork. The main prerequisite for a cure then is a collapsible cavity; and this is true regardless of the type of cure. The aeration overcomes the odor by creating an unfavorable condition for the anaerobic bacteria. The irrigation thins out the thick, viscid, and tenacious exudate so that the suction apparatus will accomplish its aspiration and removal from the lung bed and bronchial tree. The semidiagrammatic drawing (Fig. 6) shows the relation of the bronchoscope and irrigating tube to the branch bronchus that is emptying the pus into the main bronchus and to the lung abscess. The irrigating tube and the aspirator do not enter the actual abscess cavity in the lung, but do attack the abscess by way of the branch bronchus which can be seen emptying exudate into the main bronchus.

Of the chronic cases, or non-curable cases, a very large majority are markedly improved. This improvement may last a very long or a very short time according to the chronicity and size of the lesion, which can to some extent be gauged by the clinical behavior of the patient and the duration of the disease. For greater accuracy in mapping the cavities the introduction of bismuth in oil into the lung after the method of Lynah is of advantage. The use of bismuth powder after the method

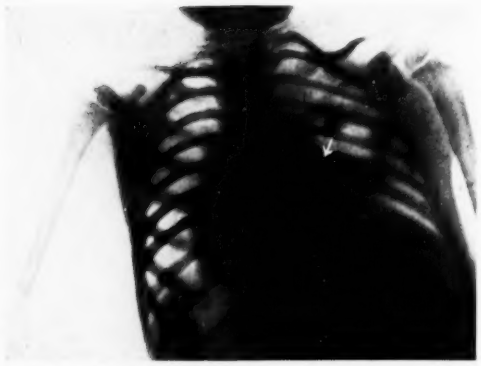

Fig. 5. T. K. Same patient several weeks after clinical cure following two bronchoscopic treatments.

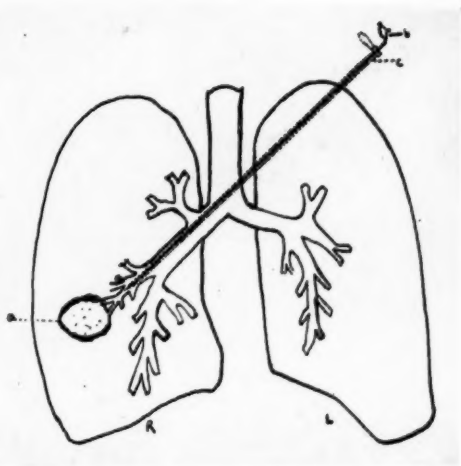

Fig. 6. Drawing showing relation of bronchoscope and irrigating tube to abscess area. *a*, Abscess area; *b*, irrigating tube; *c*, bronchoscope.

of Jackson is of particular value in outlining the bronchial tree.

Cases of moderately long standing show the following clinical picture: There is cough, profuse expectoration, the sputum is very offensive in its odor, there is clubbing of the fingers, some loss of weight, an increased pulse rate, a slight elevation of temperature, and weakness. There may or may not be hæmoptysis. As was said before all lung abscesses react favorably to treatment immediately after bronchoscopy. The duration of this favorable response to treatment is what determines whether a given case can be sufficiently helped by bronchoscopy to make it worth while to continue the treatment, or whether that case should be turned over to somebody else for pneumothorax or appropriate surgery. Marked improvement for several days is sufficient justification to continue irrigations. The favorable response to treatment brings with it a marked lessening of the frequency of the cough, the sputum is decreased in amount, the odor is no longer present, there is a recession of the clubbing of the fingers, the pulse rate and temperature approximate normal, and the patient is brighter and more cheerful. He soon gains in weight and strength.

It might be well to emphasize here the extreme importance of proper advice and instruction to these improved patients. They must keep free from upper respiratory infections in order to enjoy a measure of good health, for the introduction of infection into the respiratory passages of these patients means exacerbation of the abscess and serious illness, which is sometimes fatal.

In the consideration of the non-curable cases, it is at once evident that it is very unlikely that an abscess of several years' duration will lend itself to cure by bronchoscopic irrigation. This is because there is so much fibrous tissue in the wall of the cavity that the cavity is truly a fixed one, and a fixed cavity will not collapse of its own accord. In addition to the fibrosis in the periphery of the abscess cavity, there is a greatly thickened and adherent pleura, particularly in those cases in which the abscess is at all superficial.

It is doubtful whether cures that are reported of cases of many years' duration are reported upon a basis of subsequent clinical behavior; for such a cure is contradictory to our knowledge of pathology. There are very few abscesses which will not lose their odor and react so favorably as to give the mistaken idea of a cure immediately after irrigation. The anatomical and pathological changes necessary for a cure have not been brought about and cannot be brought about in this type of case. Those patients who are not helped very definitely by bronchoscopic treat-

ment should be referred to the surgeon. The risk involved in continuing treatment in this type of case is too great. These patients lose ground and as a result of their lowered resistance are prone to infection of the respiratory tract with its resultant pneumonia and sepsis and, frequently, termination. These patients are liable to have hæmorrhages and occasionally may develop metastatic processes in the brain.

However, in cases of long standing the patient can be kept comfortable, and at times free from symptoms as a result of bronchoscopic irrigations.

In those suppurations which are not of recent origin the first bronchoscopy pays particular attention to the condition of the bronchial tree. At this time obstructions in the form of granulations are noted and overcome. The branch bronchus which is emptying the exudate into the main bronchus is entered with the special irrigation and suction tube (12). As the calibrated end is about three-quarters of an inch longer than the aspirating tube, it makes possible additional approach to the area of suppuration, and thus a more complete irrigation is obtained. For irrigation weak iodine solution as originally advised by Yankauer; saline solution, acriflavine 1:8000, have been used. For instillation, oil of eucalyptus in sweet almond oil, pine needle oil in sweet almond oil, iodine in oil in varying strengths, has been used. The writer questions the special value of any given irrigating medium. It would seem that the mechanical flushing and cleansing is the main factor in the irrigation. Whether instillation of medicament is of value is also a question of doubt in the minds of some.

If we bear in mind what has been said concerning the chronic abscesses, which until the present time I have called the non-curable cases, it is at once evident that bronchoscopy offers some hope of cure in abscesses of short duration, in which not too great an area is involved.

A glance at Table III showing the cured cases demonstrates the importance of instituting treatment early. When acute abscesses are first seen they are aspirated only and should never be irrigated, because:

TABLE III.—CURED CASES WITH DETAILS OF INTEREST

	Sex	Age	Etiology	Duration	Lobe	Irrigations		
						No.	First	Last
M.H.	F	30	Tonsillectomy	3 mos.	R.L.	28	Jan. 1921	Mar. 1922
H.N.	M	38	Lob. Pneum.	5 wks.	R.L.	8	Mar. 1924	May 1924
J.F.	M	33	Infl. Pneum.	3 wks.	R.M.	4	Apr. 1924	May 1924
T.K.	M	4	Tonsillectomy	13 days	R.L.	2	July 1924	Aug. 1924
F.M.	M	55	Influenza	3 wks.	R.L.	1	Feb.	1924
N.L.	F	3	Tonsillectomy	3 wks.	L.U.	1	Nov.	1924

1. The infection may be spread since the process may not yet have become sufficiently localized for aspiration.

2. In early abscess nature's protective barrier is delicate and nothing should be done to interfere with it.

In these cases, at the time of the first bronchoscopy it will be found quite sufficient simply to aspirate.

CONCLUSIONS

In conclusion, I would say that bronchoscopy deserves a trial for the reasons enumerated above. This procedure which is done without anæsthesia in children, and with a small amount of local anæsthetic in adults, is free from injury of any kind to the individual when performed by skilled endoscopists. When properly performed, it is not as formidable as the profession has been led to believe. Today, in the hands of qualified workers, this treatment has no mortality, and should be considered before surgery is undertaken as surgery in most cases is deforming, and is not without danger to life.

BIBLIOGRAPHY

1. Bassim. Les complicationes bronchopulmonaires consecutive l'adenoidectomes et amygdalectomes. Thesis, Paris, 1913, No. 181.
2. Fetterolf, G., and Fox, H. The reaction of the paratonsillar tissues to tonsillectomy. Am. J. M. Sc., 1923, clxvi, 802.
3. Hedblom, C. A. The surgical treatment of acute pulmonary abscess and chronic pulmonary suppuration. J. Am. M. Ass., 1924, lxxxiii, 1577.

4. LORD, F. T. Pulmonary abscess. Boston M. & S. J., 1925, April 23, p. 785. Personal communication.
5. MACKENZIE, LUTHER. Lung abscess. New York M. J. & Rec., 1924, February, 191.
6. MANGES, M. Occurrence of lung abscess following tonsillectomy. Am. J. Surg., 1916, xxx, 18.
7. MASON, E. C. Blood coagulation. Surg., Gynec. & Obst., 1924, xxxix, 421.
8. MOORE, W. F. Pulmonary abscess, an analysis of 202 cases following operative work about the upper respiratory passages. J. Am. M. Ass., 1922, lxxviii, 1279.
9. MYERSON, M. C. Pulmonary aspects of tonsillectomy under general anesthesia. Laryngoscope, 1922, xxxii, 929.
10. Idem. Bronchoscopic observations upon the cough reflex in tonsillectomy under general anesthesia. Laryngoscope, 1924, xxxiv, 63.
11. Idem. Lung abscess following tonsillectomy, a contribution to the etiology. Arch. Otolaryngol., 1925, i, 137.
12. Idem. The description of an instrument for improved irrigation of lung abscess. J. Am. M. Ass., 1924, lxxxiii, 1429.
13. RICHARDSON, C. W. Tonsillotomy, with a consideration of its complications. Washington M. Ann., 1912, xii, 2.
14. WHITTEMORE, W. The etiology and treatment of non-tuberculous pulmonary abscess. Surg., Gynec. & Obst., 1924, xxxviii, 461.

APOPHYSITIS OF THE OS CALCIS

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INFLAMMATION of the cap-like epiphysis at the posterior portion of the os calcis is called apophysitis. This term was first used by Sever. The condition is fairly common. Its importance lies in early recognition and proper treatment, which will prevent a certain degree of permanent disability. The literature on this subject is very brief. In many textbooks on orthopedic surgery the condition is not mentioned. The most recent articles are by Allison and Fairbank. Sever reported 5 cases, Kurtz 3, Allison 2, and Fairbank 14 cases.

PATHOLOGY

According to Baetjer and Waters the separate center of ossification of the posterior extremity of the os calcis appears at the tenth and unites at the eighteenth year. It is to this structure that the tendo achillis makes the attachment for the powerful gastrocnemius, soleus, and plantaris muscles. The epiphysis is, therefore, at a great mechanical disadvantage. The period of greatest hyperæmia, which probably begins 1 year before the epiphysis is demonstrable and ends at about the fourteenth year, is the critical time in the life of the apophysis. It is then that changes in circulation and local internal and external influences cause marked alterations. These changes are in the nature of epiphysitis and osteitis and may go on to destructive lesions. Interference with the growth of the posterior portion of the os calcis results, and is serious because of the importance of this region in propelling the body in locomotion.

ETIOLOGY

The etiology of apophysitis is still under discussion. The various factors to be considered are the following:

1. Trauma may be internal or external. By internal trauma is meant the strain and stress applied to the apophysis by the triceps suræ group of muscles through the tendo achillis.

2. Infection is probably not the primary cause.

3. Glandular disturbance may be a factor in certain cases in a manner similar to "slipped epiphysis" in the hip.

4. Metabolic disturbance is probably a factor.

5. Circulatory alterations are undoubtedly very important and their relation to trauma may be very close.

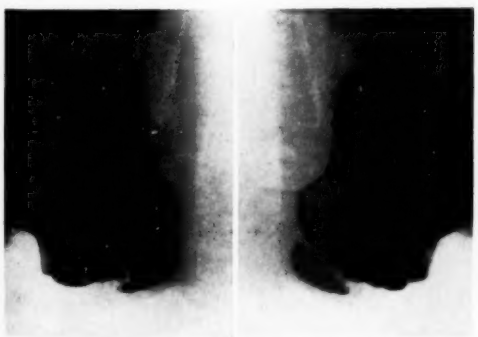

Fig. 1. Roentgenograms showing the normal heels of a 10-year-old boy.

Fig. 2. N. T. July 27, 1923. Lateral view of apophysitis modified by previous operative trauma.

Fig. 3. N. T. July 27, 1923. View from above.

Fig. 4. N. T. August 23, 1923. Lateral view.

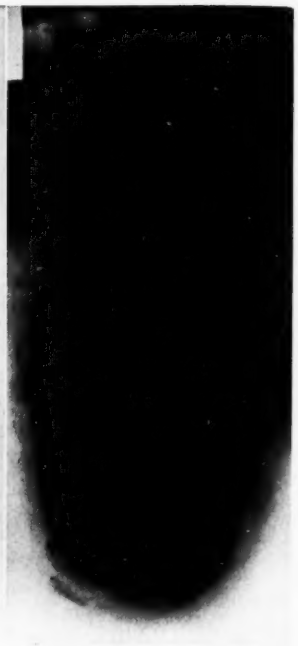

Fig. 5. N. T. August 23, 1923. View from above.

Sever's 5 cases included 3 girls and 2 boys, aged 7, 12, 12, 10, and 6 years. They were as a rule overweight, strongly muscled, and active. He quotes Rotch to the effect that the epiphysis of the os calcis may develop from 1 or 2 centers, that it appears during the ninth year and unites before puberty or soon after. Sever, however, believes that the center appears during the seventh year, and in larger children the epiphyseal development is earlier and more marked. Apophysitis never occurs after puberty.

The writer believes that apophysitis is a condition analagous to Legg's disease in the hip, Osgood-Schlatter's disease in the tibia, Koehler's tarsal scaphoiditis, Freiberg's infraction of the metatarsal head and Scheuermann's kyphosis dorsalis juvenilis or vertebral epiphysitis. He also believes that the important factors are local trauma, external and especially internal, plus local circulatory disturbances affecting the apophysis at its critical period of growth. He agrees with Allison who states that the changes in apophysitis and Legg's disease are similar. He believes, however, that the condition first described by Osgood as occurring in the upper tibial epiphysis is a more pronounced analogy because in both cases there is an epiphysis which serves as an attachment for a large tendon which is acted upon by a powerful group of muscles.

SIGNS AND SYMPTOMS

There may be a history of injury but this is not constant. The child might have been running on hard pavements wearing sandals or tennis shoes. The onset is insidious. Limp is usually the first symptom and may or may not be accompanied by pain. Pain is dull and localized to the affected area. It is less marked while wearing shoes with heels. Pressure by the shoe aggravates the pain. Swelling is present. There may be obliteration of the normal outlines due to thickening of the tissues. Signs of acute infection are not prominent. Tenderness may be present over the posterior as-

pect of the heel for weeks or even months. The child does not permit stretching of the Achilles tendon which accounts for the equinus position of the foot and the limitation of dorsiflexion. There is a disinclination to complete the full step. Slight pronation may be present.

Roentgenograms made in anteroposterior and lateral projection reveal irregularity of the apophysis with thickening in all directions. There may be clouding or partial obliteration of the epiphyseal line.

DIAGNOSIS

The direct diagnosis is based upon the history and findings enumerated above.

In the differential diagnosis the following conditions must be born in mind: achillobursitis, tenosynovitis, bursitis between the tendo achillis and skin, calcaneal spur, tuberculosis, and pyogenic infection.

Achillobursitis or inflammation of the bursa between the tendo achillis and the os calcis reveals a more superficial and localized inflammation. The roentgenogram is negative for pathological conditions of the bone.

Tenosynovitis of the achillis is characterized by pain referred to the tendon and by palpable crepitus on movement. The roentgenogram is negative.

Bursitis between the Achilles tendon and the skin is a very superficial inflammation, usually the result of pressure of the shoe, and should be easily determined.

Calcaneal spur is rare in early adolescence and is usually found on the inferior internal aspect of the os calcis. The area of sensitiveness should determine the diagnosis. The inflammation is associated with the attachment of the plantar fascia instead of the tendo achillis.

Tuberculosis of the os calcis is usually in the anterior portion or body and not in the posterior region. Other evidences of tuberculosis are absent in apophysitis, and the roentgenogram will aid very materially in the differentiation. There is no bone atrophy in apophysitis.

A pyogenic infection would produce more marked inflammatory reaction with destructive osteitis.

PROGNOSIS

The prognosis is excellent if proper orthopedic treatment is instituted. The course is comparatively short, and may vary from a few weeks to several months. The condition may recur as a result of over activity or trauma. Cure is effected when consolidation occurs between the os calcis and the apophysis.

TREATMENT

The treatment is simple. The indications are to relieve the tendo achillis of strain and to prevent weight bearing on the os calcis.

The most satisfactory treatment consists of the application of a plaster cast extending from the toes to just above the knee, in such a manner as to hold the foot in very slight equinus, thus relaxing the pull of the triceps, and the knee in very slight flexion. Two crutches and a 2-inch block under the heel and sole of the opposite shoe (in unilateral cases) aid in locomotion. This cast should be removed in 2 weeks and another immediately applied extending from the toes to the garter line holding the foot at a right angle but with no varus or valgus. At the end of 4 more weeks, this cast should be removed and a high lace shoe with a ¾ inch cork lift for the heel worn. Weight bearing with the aid of crutches should be carried out for another 2 weeks. Contrast baths, baking, or diathermy should be employed during this period.

During the course of treatment emphasis should be placed upon direct sunlight and proper food. If there is any glandular disturbance proper therapy should be instituted.

If the case is so mild that the above treatment is not indicated, it will be sufficient to elevate the heel, remove the counter of the shoe, and insert a pad of felt or sponge rubber in the heel. The heel may be protected by adhesive strapping and the pronation corrected. Rubber heels should be worn.

A report of a case follows:

N. T., white boy, age 11 years, entered St. Luke's Hospital, July 27, 1923, because of pain and tenderness in the right heel. One month previous to admission the patient noticed a pain in his right heel. This appeared one morning and increased in severity during the course of a few hours. Tenderness and swelling were also present at the outset. The area was incised, with only temporary relief; and dress-

ings alternately moist and dry, with and without drains, were applied for about 3 weeks, at the end of which time the patient was referred to the writer. There was no history of injury or infection preceding the onset of his trouble. The patient had had no trouble with his heel previously. *The general health* was negative except for underweight.

Respiratory, cardio-vascular, and gastro-intestinal systems were normal.

He was highly neurotic as were his family. *Past illnesses* included measles and chicken-pox.

Physical examination revealed an undersized, poorly nourished boy, 11 years old, with acute pain in the right heel. Complete examination revealed the following pathology. The right heel was swollen, red, and extremely painful to pressure and very sensitive to movements of the foot or leg. There was a recently made surgical wound over the back of the heel and a slight grayish discharge exuded. The pain was apparently in the bone as there was no palpable mass superficially, and the incision extended to the bone.

Roentgen-ray findings. Dr. Jenkinson reported that on the posterior surface of the right os calcis there seemed to be more than the usual irregularity, and there seemed to be several fragments of bone in the soft tissues. He believed he had the beginning of an osteitis involving this area.

August 12 the fomentations were discontinued. A cast was applied from mid-thigh to toes.

August 15 a window was cut in the cast for dressing. Heliotherapy was prescribed, and the patient discharged. Discharge diagnosis: postoperative infectious epiphysitis of right os calcis (apophysitis).

August 22 the patient returned to the hospital after an absence of 6 days. The physical condition was unchanged except for the heel; the sinus was discharging slightly more than when he left the hospital. The heel was more tender, and the cast removed.

Roentgen-ray findings. "There is a definite osteitis involving the posterior surface, as well as the posterior portion of the inferior body of the right os calcis. I believe that this is due to an infection."

Operation. The right leg was painted with a 3½ per cent tincture of iodine from the middle of the right leg to the toes, and the excess removed with alcohol.

A longitudinal incision was made over the posterior portion of the os calcis. The spongy bone which was found in the region of the apophysis was curretted thoroughly. The skin was loosely sutured with silk-worm gut sutures and the wound was packed with iodoform gauze drains.

Necrosis of the epiphysis of the right os calcis was present. A postoperative diagnosis was made of apophysitis of the right os calcis modified by previous operation which was followed by infection.

September 9, the discharge was very slight. Dressings were applied daily, Balsam of Peru being used. All stitches were removed. Drainage was adequate. He went home with instructions to have dressings continued. He was seen 3 or 4 times at my office and at present wears a half-inch pad in the heel of his shoe. He is cured.

SUMMARY AND CONCLUSIONS

Apophysitis of the os calcis is an inflammation of the cap-like epiphysis of the posterior portion of the heel bone. It is a fairly common condition occurring usually in boys between the ages of 9 and 13 years. The probable etiology is concerned with 2 factors: local external and especially internal trauma and local circulatory disturbances affecting the epiphysis during a critical period in its growth and development. The treatment consists of immobilization and relief from weight bearing plus general hygienic considerations. The prognosis is excellent. The condition is analagous to Legg's disease, Koehler's tarsal scaphoiditis, Scheuermann's vertebral epiphysitis, Freiberg's infraction of the metatarsal head, but especially to Osgood's tibial epiphysitis.

COMMENT

More roentgenological observations must be made on the normal or symptomless heels of children between 6 and 16 before accurate statements can be made about pathological heels. It is evident that there are marked "normal" variations.

Note.—The roentgenograms and the roentgen-ray findings herein reported are the work of Dr. E. L. Jenkinson.

BIBLIOGRAPHY

SEVER. New York M. J., 1912, xcv, 1025.
KURTZ. Am. J. Orthop. Surg., 1917, xv, 659.
BAETJER and WATERS. Injuries and Diseases of Bones and Joints, pp. 41 and 57.
JONES and LOVETT. Orthopedic Surgery, p. 57.
ALLISON. J. Bone & Joint. Surg., 1924, vi, 91.
FAIRBANK. Proc. Roy. Soc. Med., Sect. Orthop., 1924, October 7.

FURTHER OBSERVATIONS OF INTRACRANIAL HÆMORRHAGE IN THE NEWBORN[1]

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DURING the past 10 years, renewed interest has been aroused in the subject of acute intracranial hæmorrhage in the newborn. The valuable clinical contributions of Sidbury (19), Brady (3), Green (11), Strachauer (20), Ehrenfest (7), Conkey (5), Monroe and Eustice (16) and the careful postmortem studies of Warwick (21), Capon (4) and Barnett (1) have all recognized and emphasized the increasing importance of this intracranial complication as a factor in the well-being of the child, not only as to life itself but to its future normality, mentally and physically. Within the past 6 months, Schwartz (18) of Berlin has stated that the pathology of the first month of life is completely dominated by the birth injuries of the brain; and Fischer (10) of Basel has written that his postmortem observations at the Institute have convinced him that the 10 per cent of deaths during the first month are chiefly due to cerebral birth injuries. Huenekens (12) in a recent article states that the recognition of cerebral hæmorrhage of the newborn is a most neglected phase in their care and yet it is a most important one.

Until recent years, the study of intracranial hæmorrhage in the newborn has been limited chiefly to postmortem examinations of the extreme acute types of intracranial hæmorrhage of sufficient amount to cause the death of the baby and producing clinically well marked signs of stupor to the degree of unconsciousness, refusal to nurse and even convulsive seizures; or if an intracranial hæmorrhage of milder degree was suspected owing to the presence of slight muscular twitchings, difficulty in nursing, and a mild drowsiness, then the use of various drugs to increase the coagulability of the blood and thus aid in lessening the danger of further hæmorrhage; and finally the study of the chronic forms of intracranial hæmorrhage in the newborn—first suggested by Denis (9) in 1826, Billard (2) in 1828 and Cruveilhier (6) in 1829–35, by Little in 1843 (13) and in 1862 (14), by Sarah MacNutt (15) in 1885 and by a rapidly increasing group of observers during the past 15 years. The pathology of 75 per cent of these chronic cases of cerebral spastic paralysis associated with mental retardation of varying degree was ascribed by Little in 1862, and confirmed by MacNutt in 1885, as being due to an intracranial hæmorrhage at the time of birth; yet the significance of these postmortem studies was practically overlooked in the literature, so that the frequency of intracranial hæmorrhage in the newborn was commonly considered to be limited to those babies dying within the first 2 weeks after birth, and to those supposedly rare cases of milder intracranial hæmorrhage making apparently excellent recoveries, both of life and of future normality, with and without any definite medical treatment.

We have been impressed by the frequency of certain clinical signs, such as drowsiness, difficulty in nursing, and muscular twitchings even to the degree of convulsive seizures presented in the birth histories of a large series of selected cases of cerebral spastic paralysis, and as the pathology in these chronic cases has been demonstrated at operation or at autopsy as being due to an intracranial hæmorrhage most probably at the time of birth, and as, in a series of 46 acute cases of severe intracranial hæmorrhage in the newborn which had been examined in consultation during the ten-year period of 1913 to 1923 with accurate clinical, operative, and postmortem records of the findings, one of the writers (Sharpe) became more and more impressed that possibly intracranial hæmorrhage of varying degree in the newborn was a more common complication of birth than is ordinarily believed and that possibly the signs in the milder cases were being overlooked as of no real significance until months and years later when the condition had be-

[1] Read before the Section of Pediatrics, New York Academy of Medicine, February 12, 1925.

come a chronic one. Naturally, any treatment of these chronic cases can be directed only toward an improvement of the condition; the ideal time for treatment is during the acute stage when the blood itself in fluid form may be drained, either by the repeated lumbar punctures producing spinal drainage or in the more extreme cases by the modified subtemporal operation producing cranial drainage. In order to ascertain the frequency of intracranial hæmorrhage in the newborn and to determine, if possible, the associated clinical picture as presented by these acute cases in which an intracranial hæmorrhage of varying degree is present, permission was obtained, in January, 1923, to perform a series of lumbar punctures upon consecutive newborn babies at the City Hospital, Welfare Island, New York City, upon the services of Doctors F. A. Dorman and Wilbur Ward. To them and to Doctor Charles G. Child, the writers desire to acknowledge their indebtedness for making possible these series of observations.[1]

In this fifth series of 100 consecutive newborn babies upon whom a lumbar puncture was performed within 24 to 48 hours after birth, bloody and blood-tinged cerebrospinal fluid was disclosed in 6 cases; that is, in 6 per cent. In 19 of these 100 newborn babies, lumbar puncture was not performed; in 9, the so-called "dry tap" occurred or the spinal canal was not successfully entered; three were still-births; two were considered too feeble to be subjected to the possible added risk or shock of a lumbar puncture and 5 died before a lumbar puncture was performed. In 2 cases the puncture was contaminated with blood due to faulty technique. The males numbered 54 and the females 46, being practically the same as in the preceding series. In this fifth series, however, only 39 were first children and as large a number as 44 were of the negro race, possibly factors in the lower incidence of intracranial hæmorrhage in this series. Three of the babies having bloody cerebrospinal fluid were of primiparæ. All 6 cases having bloody cerebrospinal fluid were males, 5 white and 1 negro. Two were left occipito-anterior presentations, two were premature, one was a breech, and the other was a low forceps baby. One premature baby from whom three lumbar punctures drained bloody cerebrospinal fluid, died on the fourth day and no autopsy was performed. In three babies, the cerebrospinal fluid was yellow in two (with 6–8 red blood cells to a field) and blood-tinged in one, and it became clear after one puncture. Four lumbar punctures drained bloody cerebrospinal fluid from one baby, the Wassermann test of whose mother was 4 plus. This child was transferred to another ward for treatment and further lumbar punctures were not possible. The sixth case had bloody cerebrospinal fluid at three lumbar punctures; this baby became jaundiced on the third day, but the cerebrospinal fluid became clear 3 days after the appearance of the jaundice.

The labor was right occipito-anterior in 24 and left occipito-anterior in 55; low forceps were used in 8; breech extraction in 4; and prolonged labor in 4. Of the 6 babies having bloody cerebrospinal fluid, there were no definite signs of its presence and it would have been overlooked if the routine lumbar puncture had not been performed; the premature baby did have a weak cry and the baby with the luetic mother did have to be resuscitated, but 4 other babies in this series required resuscitation and their cerebrospinal fluids were clear. Ten babies had the cord about their necks, but in none of them was bloody cerebrospinal fluid present.

The intracranial pressure as registered by the spinal mercurial manometer was normal (5 to 8 millimeters) in 47; increased (9 plus millimeters) in 29; below normal (5 minus millimeter) in 5; and the test of lumbar puncture was not performed in 19. In the 6 bloody cases, the pressure was above normal in 3, normal in 2, and below normal in 1 (one of the premature babies that died). The fontanelles were flush in 26, bulging in 23, depressed in 43, and not recorded in 8. Of the six bloody cases, 3 were flush, 2 were bulging, and 1 depressed (one of the premature babies). Eight mothers disclosed a positive

[1] The preceding four series of 100 consecutive newborn babies each, upon whom a lumbar puncture was performed within 24 to 48 hours after birth, have been reported in detail as follows:

1. J. Am. M. Ass., 1923, Aug. 25.
2. Surg., Gynec. & Obst., 1924, Feb.
3. Am. J. Obst. & Gynec., 1924, Aug.
4. Am. J. Obst. & Gynec., 1925, April.

Wassermann reaction; of their babies, 5 had clear cerebrospinal fluid, one bloody cerebrospinal fluid, one died before lumbar puncture and an autopsy did not disclose an intracranial hæmorrhage, and in one the lumbar puncture was not successful. Of the 3 stillbirths, one autopsy was negative for intracranial hæmorrhage and autopsy was refused in the other two cases.

The coagulation-time of the blood was within normal limits for each one of the six cases having bloody cerebrospinal fluid, being respectively, 5½ minutes, 5 minutes, 3½ minutes, 6 minutes, 5½ minutes, and 4 minutes. Not one baby in the entire series had a clotting time over 7½ minutes. These observations would tend to confirm the belief of Ehrenfest (7) who states that undue stress is being laid upon the hæmorrhagic diathesis and that the widespread significance of artificial, mechanical, and physiological trauma incident to birth, is being overlooked.

The technique used in these series of newborn babies has been as follows: A lumbar puncture needle of the size and caliber of the ordinary intramuscular needle was inserted into the fourth lumbar interspace—the baby being flexed in the horizontal position by a nurse so that the head and knees were approximated, and care was taken to have the spinal canal and the median line of the head on a level and parallel with the table. Upon entering the subarachnoid space successfully, the small rubber tube attached to the spinal mercurial manometer was connected with the puncture needle and a careful reading of the pressure was made, the child being quiet and the acute anterior flexion of its body being relaxed. The opening of a stopcock on the needle now permitted cerebrospinal fluid to escape into a sterile test tube. The character of the fluid was noted and if clear and under normal pressure (4 to 8 millimeters), 2 cubic centimeters for laboratory examination were drained into the test tube. If under increased pressure (above 8 millimeters) and especially if bloody, blood-tinged, or yellow, then an amount was allowed to escape slowly until the pressure registered by the manometer became normal, care being taken not to permit the fluid to escape rapidly in a quantity large enough to lower the pressure below normal. Thus it was possible to estimate accurately just how much fluid could be drained safely and with no danger of medullary pressure or vascular complications. If the fluid was bloody to any degree, then an immediate second puncture was performed in the third lumbar interspace merely to confirm the presence of blood in the cerebrospinal fluid of the first puncture. Blood due to the puncture itself, technically, is differentiated by the fact that this extraneous blood streaks the cerebrospinal fluid as it drips from the needle and is not homogeneously mixed throughout the cerebrospinal fluid in the test tube; besides, the second lumbar puncture is another control of the findings, both of the blood and pressure as disclosed. According to the pressure and blood consistency of the cerebrospinal fluid, a lumbar puncture of spinal drainage was performed in our first series every 24 hours until the cerebrospinal fluid became clear and under normal pressure. In the later series, however, the interval between drainage punctures was made every 12 to 24 hours, and in the last series of test cases, a puncture of spinal drainage was being considered even as frequently as every 6 hours, according to the pressure and the blood consistency of the cerebrospinal fluid. That is, the method of lumbar puncture was used not only as a means of diagnosis, but more as an active method of drainage of the free blood in the cerebrospinal fluid in the hope that clotting of this free blood could be entirely avoided, so that there would not remain unabsorbed any hæmorrhagic clot and thus possible organization residue and future blockage of the normal absorption of the cerebrospinal fluid.

The following case history is rather instructive:

First-born, full-term baby, weighing 6 pounds, 4 ounces, was delivered as a breech at 7 a.m., November 12, 1924. Resuscitation was necessary. One hour after birth, a small quantity of blood was vomited; no melæna was present and the meconium was normal. The baby remained in a very drowsy condition for several hours with rather labored respiration, and upon the appearance of muscular twitchings about the right orbit, an intracranial hæmorrhage was suspected. At consultation 6

hours after birth, these notes were made: Temperature 103.6; fairly well nourished baby of pasty color; very drowsy; the occasional cry was weak; body heat was maintained by hot water bags. Anterior fontanelle was flush but very tense. Right palpebral fissure was smaller than the left. Marked nystagmoid twitches, especially upon looking upward; definite upward skew deviation of left eye. Twitchings of the left supra-orbital muscles with a tremor of the upper left eyelid lasted several seconds at short irregular intervals. The left hand was held flexed in a state of tonic spasm. No spasticity of legs elicited; reflexes were negative. In order to determine whether or not an intracranial hæmorrhage had occurred, and if it had, then to use at once repeated lumbar punctures of spinal drainage to aid in its complete absorption, a lumbar puncture was advised. The cerebrospinal fluid was very bloody (60 to 75 per cent blood) and under a pressure of 16 millimeters as registered by the mercurial manometer (normal pressure being 5 to 8 millimeters); 4 cubic centimeters were removed. Within 3 hours, the child's condition improved, the color cleared. The baby became brighter and although still drowsy the breathing was easier and the twitchings of the left supra-orbital muscles ceased. A second lumbar puncture was advised, however, 5 hours after the first, in the belief that still further drainage of the hæmorrhage might be indicated. Three cubic centimeters of very bloody cerebrospinal fluid were removed. Thirty hours after birth, the general condition of the child was still poor but distinctly better than on the preceding day. Temperature 104.6. The child was drowsy and slightly jaundiced and had not begun to nurse. There were occasional twitchings of the left supra-orbital muscles, a slight ecchymosis of the left foot and toes. The fingers of left hand were in tonic flexion and a definite hæmatoma was at site of earlier lumbar puncture. To aid the natural means of absorption of the intracranial hæmorrhage, a third lumbar puncture of spinal drainage was again advised, but the spinal canal could not be successfully entered. Fifty hours after birth, the general condition of the baby had markedly improved. Temperature was 99.4. The color was much better and when the baby was aroused the cry was stronger. The tonic spasm of the left hand still persisted and nursing had not commenced. A fourth lumbar puncture now disclosed bloody cerebrospinal fluid and 3 cubic centimeters were removed. Seventy-two hours after birth, the general condition had so improved that no further lumbar punctures were considered advisable. Temperature was 98.4. The cry was lusty and the normal demand for food was present and the child nursed. The entire clinical picture had cleared and the convalescence was uneventful. At one month of age, the baby was considered normal. Seven weeks after birth, it was noticed that the anterior fontanelle was becoming tense and then began to bulge. At consultation, on January 10, 1925 (8 weeks after birth), we find a well nourished baby. The anterior fontanelle is large, tense, and protruding, the sagittal suture is open and extends backward into an open and tense posterior fontanelle. The coronal suture is also separated. Neurological examination was negative with the exception that the ophthalmoscopic examination disclosed a distinct pallor of both optic disks. Lumbar puncture revealed clear cerebrospinal fluid under an increased pressure of 20 millimeters as registered by the mercurial manometer; upon removing 3 cubic centimeters, the anterior fontanelle gradually became less tense, receded and pulsated for a period of almost 24 hours, when it again became tense and bulging; the gradual lessening of the intracranial pressure following the lumbar puncture may have been due to a continued seepage of cerebrospinal fluid through the punctured lumbar dura and into the tissues of the back. The tentative diagnosis was obstructive hydrocephalus of the communicating type. On January 27, 1925 (10 weeks after birth), another consultation confirmed the findings of the preceding examination and the hydrocephalic condition was becoming more marked; a divergent strabismus had now appeared.

This case history of extensive intracranial hæmorrhage at birth and then the later development of an obstructive hydrocephalus due most probably to a partial blockage in the absorption of the cerebrospinal fluid by the organization residue of unabsorbed hæmorrhage, is most interesting and highly suggestive that intracranial hæmorrhage of large amount in the newborn and yet of insufficient amount to cause the death of the baby, may be a more common etiological factor in obstructive hydrocephalus than formerly believed. Milder degrees of blockage in the absorption of the cerebrospinal fluid, due either to a less extensive supracortical hæmorrhage or to a greater absorption of the hæmorrhage and therefore a lessened amount of organization residue, would produce therefore only a mild increase of the intracranial pressure—so often demonstrable in the milder types of external hydrocephalus. This case history also emphasizes the importance of the treatment, not only of the acute condition as far as the recovery of life itself is concerned but also of the future normal condition of the child, and that merely because the acute condition is improved clinically, this gratifying immediate result should not eliminate the necessity of active treatment to remove all of the hæmorrhage for fear of future impairment.

In this series, as in the preceding four series, it has been very surprising not to have found a lengthened coagulation time of the blood, at least in several of the 46 cases that had bloody cerebrospinal fluid in the total series of 500 newborn babies. The Rodda (17) method was used, and although the bleeding time might still be lengthened and yet the coagulation time apparently be within normal limits, the great importance formally ascribed to hæmorrhagic disease of the newborn as *the* etiological factor in intracranial hæmorrhage of the newborn seems unwarranted—at least in these series of observations. Two of the 6 babies having bloody cerebrospinal fluid in this series were premature and as in the preceding four series, it does seem that these premature babies are more liable to this intracranial complication of hæmorrhage than are the ones born at full term. Whether this is due in part to the walls of their supracortical veins not being sufficiently developed and therefore not so resistant to the dilatation and venous congestion associated with birth and rupturing more easily, can only be surmised as a possible explanation. Breech extraction in this series is again a frequent cause of intracranial hæmorrhage in the newborn, and prolonged labor when low forceps are used as a last resort instead of being used early is also a definite etiological factor.

In the preceding series, the proportion of males to females has been about the same, an equal number. The mothers have been primiparous in about one-half of the cases. In this series, however, although the males about equal the females in number, only 39 were first children and as large a number as 44 were of the negro race. As suggested above, these factors may account for the lessened incidence of bloody cerebrospinal fluid in this series as compared with 9 per cent, 13 per cent, 10 per cent, and 7 per cent in the 4 preceding series, respectively.

The clinical signs have been most meager and if a routine lumbar puncture had not been performed, it is doubtful if the condition of intracranial hæmorrhage could have been even suspected in many of the cases. Difficulty in nursing and prolonged drowsiness were the two most common signs.

Only 4 lumbar punctures were necessary in this series to obtain clear cerebrospinal fluid, as compared with 7, 8, and even 9 punctures in three cases of the preceding series. Possibly the free blood as disclosed by lumbar puncture would have been entirely absorbed by the natural means of absorption of the cerebrospinal fluid through the stomata of exit in the walls of the supracortical veins, through which over 80 per cent of the cerebrospinal fluid is normally excreted, and the remainder into the sinuses, Pacchionian bodies, etc. Yet it does seem rational that the additional spinal drainage of repeated lumbar punctures would aid in the complete absorption of the free blood which might be in an amount too large to be entirely absorbed by the natural means of absorption —in which case there would be the great danger of the organization residue of hæmorrhage causing a future impaired child, both physically and mentally. The added risk of a lumbar puncture appears to be practically nil in the babies of these series of observations. On the other hand in babies of low vitality and especially if premature, or babies in the state of severe shock, no lumbar puncture should be performed nor indeed any prolonged examinations made that might increase the shock. As in the treatment of acute brain injuries in adults, if the patients cannot survive the shock of the cranial injury, surely no prolonged examinations, tests, lumbar punctures, and by no means cranial operation, will aid them. If such patients do recover life even with such treatment during this period of shock, then they recover in spite of the treatment. Patients in shock with intracranial hæmorrhage of the usual type, supracortical venous bleeding, cannot continue bleeding intracranially to any large extent, because very quickly the resulting increased intracranial pressure will become greater than the lowered general arterial blood pressure of shock, and therefore the intracranial hæmorrhage then lessens. As the baby recovers from the acute condition of shock, then the general arterial blood pressure rises so that it again becomes possible for intracranial venous hæmorrhage to occur, unless coagulation of the blood of the ruptured supracortical

veins is now of sufficient degree to prevent continued venous oozing.

The use of blood coagulants, such as calcium lactate, mother's blood, and hæmostatic sera, etc., may be of value to increase the coagulability of the blood even if the coagulation time is normal. However, to limit the treatment of these cases of intracranial hæmorrhage in the newborn merely to increasing the coagulability of the blood with no treatment directed to drain from the cerebrospinal system the blood already escaped from the ruptured vessels, seems to us not all we could hope for. If the child recovers then there is the great danger of future cerebral impairment. It is our opinion that the more rational treatment of these acute cases would be a combination of both methods: increasing the coagulability of the blood to lessen further hæmorrhage and the aiding of the normal means of absorption of the blood already free in the cerebrospinal fluid by repeated lumbar punctures of spinal drainage and in the rare extreme cases even cranial drainage by modified subtemporal decompression. Naturally, the earlier the true intracranial condition of hæmorrhage in these cases is recognized and its appropriate treatment instituted while the blood is still in fluid form, just so much better is the prognosis both as to life and to future normality. Theoretically, the use of blood coagulants alone in the treatment might in certain cases of large hæmorrhage produce a too rapid coagulation of the blood already escaped from the supracortical veins and lying upon the cerebral cortex, so that this blood clot could be less easily absorbed by the natural means of absorption, thus defeating in part the object of the treatment.

Apparently, then, the treatment in these cases should be a combined one—increasing blood coagulation and draining *early* whatever hæmorrhage has already occurred in its fluid form, both removing the free blood from the cerebrospinal system and at the same time diluting and lessening the blood consistency of the cerebrospinal fluid, so that this free blood clots less rapidly, thus facilitating its continued absorption by the natural means of excretion.

BIBLIOGRAPHY

1. Barnett, E. J. Northwest. Med., 1922, xxi, 243.
2. Billard. Paris, 1828.
3. Brady, J. M. J. Am. M. Ass., 1918, lxxi, 347.
4. Capon, N. B. J. Obst. & Gynæc., Brit. Emp., 1922 xxix, 572.
5. Conkey, O. F. Arch. Ped., 1923, p. 239.
6. Cruveilhier. Paris, 1829, 35.
7. Ehrenfest. Birth Injuries of the Child. New York: D. Appleton & Co., p. 39.
8. Idem. Am. J. Dis. Child., 1923, xxvi, 503.
9. Denis. Commercy, 1826.
10. Fischer, B. Schweiz. med. Wchnschr., 1924, Oct. 2.
11. Green, R. M. Boston M. & S. J., 1914, clxx, 682.
12. Huenekens, E. J. Care of the newborn. J. Am. M. Ass., 1923, lxxxi, 624.
13. Little, J. W. Deformities of the Human Frame. London: 1843.
14. Idem. On the influence of abnormal parturition, difficult labors, etc., upon the mental and physical condition of the child. Obst. Tr., 1862, iii, 243.
15. MacNutt, Sarah. 1885.
16. Monroe and Eustice, R. S. Am. J. Dis. Child., 1922, xxiv, 273.
17. Rodda, F. C. Am. J. Dis. Child., 1920, xix, 268.
18. Schwartz, P. Deutsche med. Wchnschr., 1924, Oct. 3.
19. Sidbury, J. B. Arch. Ped., 1920, xxxvii, 545.
20. Strachauer, A. C. Minnesota Med., 1920, Dec.
21. Warwick, Marg. Am. J. M. Sc., 1919, clviii, 95.

THE INTRACRANIAL COMPLICATIONS OF POSTERIOR SINUS INFECTIONS

Report of an Unusual Case with Autopsy Findings

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THE development of our knowledge of the intracranial complications of accessory nasal sinus disease has formed one of the most interesting chapters of rhinology, both clinically and pathologically. Studies of large series of autopsy records have demonstrated the relative frequency of intranasal suppuration as a cause in cerebral pathology. Newton Pitt (15) in 1890 analyzed 9,000 autopsies at Guy's Hospital and found 57 cases of brain abscess. In only one had nasal disease been responsible for a brain abscess. Gowers (5) in 1893 in discussing the etiology of brain abscess, stated that only a small proportion were secondary to nasal disease (6 cases of 240). Treitel (20) in 1895 reported 6,000 autopsies at the Berlin Pathological Institute with 21 brain abscesses, of which 3 were due to suppurative sinus disease.

When the frequency of nasal suppuration began to be appreciated, following the introduction of routine examination of the nuses at autopsy, it was at first thought to b terminal and of no clinical significance. E. Fraenkel (3) in 1896 found sinus pathology in over 40 per cent of his autopsies; Lapelle (11) in 1899 in 32.5 per cent; while Martin (12) in 1900 gives records of 31 autopsies, in 15 of which there was an empyema of the sinuses. Wertheim (22) in 1900 made a routine examination of the nasal accessory sinuses in 360 necropsies; 195 were normal, 165 showed abnormalities of various degrees. In 26.3 per cent (95 cases) the changes were classified as empyemas.

With the increasing number of reports of fatalities due to sinus disease, it soon came to rank in importance with otitis media and trauma in etiological significance. At the present time a number of such cases are recognized clinically every year in all large hospitals, some of which are proved at autopsy. Yerger (23) reports 16 fatal cases from the records of the Cook County Hospital during the period 1911 to 1920. During this time 290,000 cases were treated, of which 390, 0.13 per cent, were acute or chronic sinusitis with a mortality of 2.43 per cent.

Mrs. M. P., age 35, entered the Cook County Hospital on January 13, 1923, on the service of Dr. Vernon David with an admitting room diagnosis of probable brain tumor. She complained of pain in the right eye, pain in the head, and inability to open her right eye. The duration of these symptons was 6 months, with an insidious onset. The history obtained from her husband was that the patient fell down 4 years ago striking the back of her head. She was well until a year ago (January, 1922) when she became deaf in the right ear. At times there was a discharge from the nose which made the back of her head feel better. For the past 6 months there had been loss of vision in the right eye. Exophthalmos of the right eye was present for about 3 months. No vomiting. No frontal headache, but there was pain in the right back of the head especially at night. For about 3 weeks she had been irrational at times. Her appetite was good, but loss of weight amounting to about 40 pounds had occurred in the past 3 months.

Physical examination revealed a white adult female about 35 years old, poorly nourished and apparently acutely ill. Temperature 101.8 degrees F., pulse 104, respiration 40, on admission. The pupils were irregular, the right did not react. The left reacted to light and in accommodation. There was marked exophthalmos of the right eye and a complete ptosis. Ears, externally, were negative; internally, the left ear appeared normal; the right drum membrane was lusterless and quite scaly. In the upper posterior quadrant was a scab-like material resembling dried blood. Nose was negative to external examination. The upper teeth were all missing, many of the lower were out, and there were several old decayed roots remaining. Marked pyorrhœa alveolaris was present. The tongue was swollen, red, raw and beef-like in appearance. There was marked ulceration of the soft palate, especially on the left side where the greater part of it had sloughed away. Ulceration was still active, there being a purulent exudate along the edge. The pharynx was red, injected, and had a dry glazed appearance. The thyroid gland was moderately enlarged and the posterior cervical glands were palpable.

The chest was normal in shape; expansion, good and equal. The lungs showed normal resonance;

Fig. 1. Photograph of the brain showing complete suppurative softening of the right optic nerve.

voice sounds and fremitus were normal. Heart borders were normal. The apex was in the fifth interspace at the nipple line. Tones were present over all areas, clear and distinct. The liver, kidneys and spleen were not palpable. No tenderness, rigidity or tumor masses were present in abdomen. There was a slight superficial excoriation about 5 millimeters in diameter in the skin over the tip of the coccyx, and there were a few hæmorrhoidal tags about the anus.

On January 15, 1923, the patient was transferred to the neurological service of Dr. George B. Hassin, for diagnosis and treatment. The important points in the neurologic examination were: A marked loss of strength. All the muscles were very flaccid, flabby, and hypotonic. There was a marked intention tremor of both upper extremities, rather coarse but fairly rapid. Reflexes were all normal except a decreased right corneal reflex. The Kernig, Brudzinski, leg and neck signs were all positive; Babinski negative.

Examination of the cranial nerves showed total blindness of the right eye; palsy of 3, 4, 6, and 7 on the right side; total deafness on the right side (paralysis of eighth nerve), watch tick was heard at about 6 inches from the ear on the left side. The tongue showed a marked tremor (twelfth nerve).

Mental examination showed attention and co-operation, poor; intelligence, fair; and memory, doubtful.

Examination of the soft palate at this time showed extensive healed ulceration with bands of adhesions running to the posterior pharyngeal wall. The uvula was completely eroded away. Temperature 104 degrees F. Examination of the lungs January 15, 1923, showed no dulness, but there was suppressed breathing and a few showers of crepitant râles over the right base. Examination of the eyes by Dr. George F. Suker showed ophthalmoplegia externa and interna, right eye. Primary optic atrophy, right eye.

Spinal puncture revealed normal pressure, fluid slightly cloudy. The globulin and benzidin tests were positive. There were 80 cells per field, of which 32 were lymphocytes, 48 polymorphonuclears, and a few erythrocytes. The Wassermann reaction on the blood was positive, on the spinal fluid, negative. The diagnosis made at this time was basilar meningitis (luetic) with the possibility of a retro-orbital gumma as the cause of the marked exophthalmos; luetic ulceration of the soft palate and luetic glossitis; hypostatic œdema of the right lower lobe of the lung.

The patient was placed on antiluetic treatment and on January 17, 1923, the temperature went down to 99 at one reading, but rose to 103 in the afternoon. She continued comatose and on the 18th died in coma with a temperature of 106.8 degrees F. just before death, and with signs of a hypostatic pneumonia over the right lower lobe posteriorly.

The evening before the patient died I spoke to her husband and attempted to obtain additional information as to her past history. She had never had any miscarriages and had several apparently healthy children by her first husband. She had been married to her present husband 3 years, but they had no children. Before he left he showed me a number of X-ray pictures of the sinuses that had been taken before the patient came to the hospital and that indicated a definite clouding of the right ethmoid and sphenoid cells. The patient, however, was too ill for a satisfactory rhinoscopic examination.

Autopsy findings. The autopsy was performed by Dr. H. Gideon Wells about 12 hours postmortem.

External appearance: The body is that of a slenderly built woman about 35 years old. There is a depressed scar 2.5 by 1 centimeter in the scalp at the left of the hair line. It is brownish yellow and not adherent to the skull. There is a cutaneous scar 2 centimeters in diameter, midway between this scar and the orbital sinus. There is no noticeable exophthalmos of the right eye. The left pupil is ¾ millimeters in diameter, the right 1½ millimeters. There is no icterus. The superficial lymph glands are not palpable. There is a pigmented mole in the right arm. There is no œdema. Rigor mortis is present. There are no striæ of pregnancy on the abdomen. The mammary glands are atrophic. The external genitalia are normal. There is a small superficial ulcer over the coccyx.

Abdominal cavity: There is nearly 1 centimeter of subcutaneous fat. The peritoneum is smooth and dry. There are adhesions between the liver and diaphragm and between the liver and parietal peritoneum. There are fibrous adhesions over the tip of the appendix which is free. There are no other adhesions; the tubes and fimbriæ and gall bladder are free. The pelvic peritoneum shows many pigmented spots and fibrous tags over the bowels and bladder. The in-

testines are empty. The femoral and inguinal rings are closed. The diaphragm is at the fourth interspace on the right and at the fifth rib on the left side.

Pleural cavity: The lungs meet at the mid-line. There are dense fibrous adhesions at both apices and over the diaphragm posteriorly extending upward to completely obliterate the cavity posteriorly on the right side.

Pericardial cavity: The pericardial cavity is normal in its structure and fluid content.

Mouth and pharynx: There are no upper teeth and the few lower teeth are in poor condition. The soft palate is adherent to the pharyngeal wall, so that it forms a pocket involving the upper half of the pharynx and palate on the right side. The tongue is atrophic and flattened posteriorly. There are fibrous adhesions between the nasopharynx and soft palate. The right tonsil contains pus in its crypts. The epiglottis is normal. The larynx, trachea, and œsophagus are normal.

Thyroid and thymus: The thymus is missing. The thyroid is large (160 grams) and contains in each lobe several nodules of tissue of different color from the rest of the gland—the largest of these (2 centimeters in diameter) is partly calcified. Elsewhere the gland is exceptionally rich in colloid.

Heart, aorta and vessels: The heart weighs 300 grams and has stopped in systole. The coronary vessels are not unduly tortuous and are not sclerotic. The ductus arteriosus and foramen ovale are closed. The usual postmortem clots are present. The heart valves are normal except for slight warty thickenings along the line of closure of the aortic and mitral valves and a slight fibrous vegetation on the aortic valve. The myocardium is normal except for a scar about 3 by 1.5 centimeters in the anterior septum between the ventricles; this has a dense center and fades out into the adjacent myocardium. The aorta throughout is grossly normal except for a few yellow fatty streaks.

Lungs: The lungs collapse incompletely. Each weighs 520 grams. There are scars in both apices where fibrous nodules are palpable. There is some fibrin on the posterior left pulmonary pleura. The posterior portions of both lungs are boggy, mottled, and nodular. Cut surfaces are mottled, dark red in color. In the posterior portions of both lungs there are numerous small gray granular areas of consolidation, in the dependent parts. The anterior portions of both lungs are somewhat inelastic but not œdematous. The main vessels are free from thrombi. The bronchi are hyperæmic but not purulent.

Peribronchial glands: These are for the most part normal. One tracheal gland shows an extensive caseocalcareous lesion. One gland at the hilum of the right lung contains a small calcified tubercle.

Liver: The liver weighs 1,340 grams. The cut surface is mottled. No fibrosis and no gummatous lesions are evident. The gall bladder is normal.

Spleen: The spleen weighs 140 grams and shows no gross abnormalities.

Fig. 2. Photomicrograph of a section of the wall of the right sphenoidal sinus showing necrosis and suppuration of the bone (×60).

Pancreas is normal.

Gastro-intestinal tract: The stomach and intestines are normal. The reaction is hyperæmic but otherwise normal.

Adrenals: The adrenals are somewhat large but do not contain much lipoid.

Kidneys: The kidneys are alike and weigh together 320 grams; the cut surface is pink and bulges somewhat. Cortical markings are somewhat obscured. The capsule is extremely adherent. The cortex is slightly thinned. The pelvis is normal. The urinary bladder is normal.

Generative organs: The vagina is smooth. The cervix of the uterus is wide and gaping and exudes a bloody fluid. The corpus uteri contains a blood clot. The left ovary contains a large yellow corpus luteum. There is a cyst attached to the right ovary and there is a calcified thrombus in a vein of the left broad ligament.

Lymph glands in general: The retroperitoneal, mediastinal, mesenteric and cervical lymph glands are not abnormal in size or appearance.

Brain and meninges: The dura is tense and is not as transparent as normal. It is not adherent to the calvarium or the pia. The brain is pushed up and the convolutions flattened. The right optic nerve is embedded in a purulent sheath which gives off a putrid odor. The contents of the orbit behind the eye are entirely necrotic and infiltrated with thick pus, so that individual structures are unrecognizable. The dura is adherent in this vicinity and the necrosis extends over the sella turcica. The floor of the skull anteriorly is red and rough as far as the cribriform plate and an isolated piece of the orbital surface of the ethmoid bone can be picked out with the forceps.

Fig. 3. Cross section of the right optic nerve showing destruction of the fibers and polymorphonuclear leucocytic infiltration particularly marked at the periphery (×60).

The orbital portions of the greater and lesser sphenoidal wings are necrotic. There is a perforation of the nasal septum. The right posterior ethmoid and sphenoid sinuses are full of solid pus. The hypophysis is unrecognizable. The right gasserian ganglion is normal. The right cavernous and circular sinuses contain a purulent thrombus and the tissues about them are necrotic. The other sinuses are normal. There is a focus of necrosis behind the left optic nerve.

Skeleton: The bones of the trunk are normal. The frontal bone shows no changes beneath the scar on the forehead.

Anatomical diagnosis: Suppuration in the right posterior ethmoidal and sphenoidal sinuses extending along the right optic nerve and involving the sella turcica, destruction of the hypophysis, suppurative thrombus in the right cavernous and circular sinuses. Necrosis of the orbital portions of the ethmoid and sphenoid bones. Perforation of the nasal septum. Syphilitic cicatrix of the right pharyngeal wall and atrophy of the dorsum of the tongue. Healed syphilitic gummata of the myocardium. Scar in the scalp. Bilateral hypostatic bronchopneumonia. Bilateral adhesive fibrous pleuritis. Caseocalcareous tuberculosis of the peribronchial lymph glands. Healed tuberculous scars in both pulmonary apices. Slight chronic interstitial nephritis.

Parenchymatous changes in the kidneys. Fatty changes in the liver (slight). Menstruating uterus and corpus luteum in the left ovary. Healed fibrous peritonitis. Phlebolith in the left broad ligament. Adenomatous and diffuse colloid hyperplasia of the thyroid gland (goiter). Slight terminal acute vegetative aortic and mitral endocarditis.

Smears from the pus and sections of the sinus wall were examined by Dr. I. Pilot in connection with his studies of the bacteriology of putrefactive infections, and he found numerous streptococci, bacilli, and spirochætæ such as he has described in gangrene of the lung.

Histological sections of the sinus wall showed the mucosa transformed into a pyogenic membrane, but the bone itself was intact. There was no evidence of syphilitic involvement of the bone or mucoperiosteum. In sections taken from the suppurative area there were seen only necrosis and leucocytic infiltration with no evidence of tuberculosis or syphilis. No traces of the hypophysis remained. In cross sections of the right optic nerve at the chiasm, no normal tissue could be found. The entire nerve was replaced by a necrotic mass of tissue densely infiltrated with polymorphonuclear leucocytes, indicating an acute process. The brain tissue in the neighborhood of the optic chiasm was the seat of a diffuse encephalitis with marked polymorphonuclear infiltration of the perivascular lymph spaces.

CEREBRAL COMPLICATIONS OF SINUS

The cerebral complications associated with accessory nasal sinus disease are the most serious and usually fatal. They are due to extension of an inflammatory process, occasionally a malignant tumor to the brain or its meninges producing pachymeningitis, leptomeningitis, involvement of the brain substance with the formation of an abscess, extradural or intradural abscess and thrombophlebitis of the cerebral sinuses, or a combination of these.

Exact figures of the relative frequency of intracranial complications are difficult to obtain. The early reports consist largely of single case reports. Yerger (23) collected 16 out of a total of 390 cases of acute and chronic sinusites, 4 per cent, from the records of the Cook County Hospital during the period 1911 to 1920 inclusive.

ETIOLOGY OF SINUS INFECTIONS

Kuhnt (10) distinguishes between primary infections depending upon inflammations of the sinus mucosa and secondary lesions due to disease of the bone, such as trauma, foreign bodies, tumors. Since the sinus mucosa is a continuation of the nasal mucosa, acute and chronic rhinitis frequently lead to infection of the sinuses. If drainage is adequate, the sinusitis subsides with the rhinitis. Of infectious diseases that frequently lead to sinusitis, the

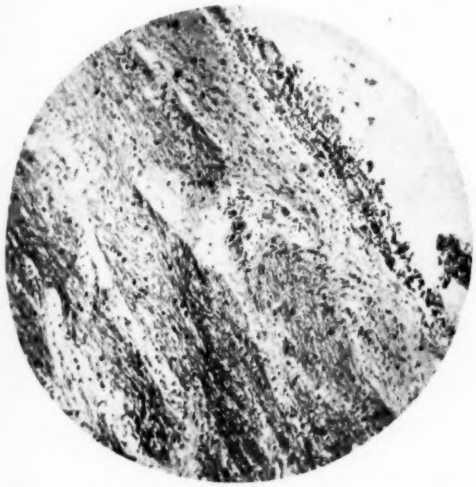

Fig. 4. Longitudinal section of the left optic nerve. Polymorphonuclear leucocytic infiltration of the sheath (×100).

Fig. 5. Section of brain tissue at the base showing perivascular leucocytic infiltration (×120).

following may be mentioned: measles, scarlet fever, diphtheria, erysipelas, pneumonia, typhoid fever, influenza, glanders, actinomycosis, lues, and tuberculosis. According to the type of inflammation, three varieties are recognized: sinusitis catarrhalis, blennorrhagica and pyorrhœica. One variety very commonly goes over into another, especially catarrhal into suppurative. Clinically, sinus infections may be acute or chronic with exacerbations and remissions over a period of months and years.

The mortality from sinus infections is due entirely to cerebral complications. Birch-Hirschfeld (2) reports 409 cases of nasal accessory sinus disease with 52 deaths, a mortality of 12.7 per cent. Infections of the sphenoidal sinus were associated with the highest mortality, comprising 28 per cent of the total; the ethmoidal sinus, 6 per cent. The following causes of death were found: meningitis, 34; frontal lobe abscess, 15; sinus thrombosis, 6; sepsis, 2. In Yerger's (23) series of cases the ethnoidal sinus was involved in 12 per cent, the sphenoidal sinus in 2 per cent. However, with respect to the occurrence of intracranial complications the sphenoidal sinus ranked first with 55 per cent, while the ethmoidal sinus was second with 19 per cent.

THE ANATOMY OF THE POSTERIOR SINUS GROUP (ONODI, 13)

In order to appreciate clearly the frequency of intracranial complications of posterior sinus disease, a knowledge of their normal and pathological anatomy is necessary.

The ethmoidal labyrinth is impacted between the frontal and sphenoidal sinuses in the sagittal position. Externally it borders on the orbital cavity, internally upon the middle and superior turbinal and the middle and superior meatus. The labyrinth is built up of ground lamellæ which separate its various divisions from each other. The lamellæ studied by Seydel extended to the processus uncinatus, the bulla ethmoidalis, the middle and superior turbinals. The passages between the lamellæ are termed interturbinal passages. They are separated into ethmoidal cells by transverse septa and ledges. These cells vary considerably in position and extent.

The ethmoidal cells are divided for general description into anterior and posterior. The anterior cells open into the middle, the posterior into the superior meatus of the nose, although an anterior cell may lie posteriorly and a posterior cell anteriorly. The anterior cells may communicate with the recessus frontalis, the ductus nasofrontalis, hiatus semi-

lunaris and recessus bullaris. The anterior portion of the middle meatus may be the seat of communication between the frontal, maxillary, and anterior ethmoidal cells. The bulla frontalis is the ethmoidal cell directly behind the frontal sinus, its wall forms part of the wall of the frontal sinus; the fronto-orbital cell is located in the horizontal plate of the frontal bone. The ethmoidal cells of the superior meatus are in general termed the posterior ethmoidal cells. The last cell may extend into the sphenoid bone and on this account Zuckerkandl (24) has named it the sphenoidal ethmoid cell. This cell may lie above the sphenoidal sinus bordering on the sella turcica and optic foramen. Onodi has termed the posterior ethmoidal cells which extend to the horizontal plate of the frontal bone the posterior fronto-orbital cells.

The bulla frontalis, the fronto-orbital cell and the turbinal cell of the frontal group are inconstant; in the posterior group, the sphenoidal ethmoid cell, the fronto-orbital cell, and the turbinal cell are equally inconstant. In the middle meatus the bulla ethmoidalis produces a constant structure by its formation of the hiatus semilunaris. The bulla ethmoidalis may vary greatly in size. Posteriorly, it may approach the sphenoidal sinus; above, the anterior cranial fossa. It empties into the middle meatus, but may open into the superior.

The posterior ethmoidal cells belong to the group emptying into the superior meatus. Individual posterior cells may empty into a neighboring cell. Their extent is very variable. They may extend far forward, posteriorly or into the horizontal plate of the frontal bone.

Of special practical importance in the spread of pathological processes is the occurrence of bony dehiscences in the ethmoidal sinuses. In a study of 4,000 skulls, Onodi found in 18 cases congenital dehiscences in the lamina papyracea of the ethmoid. Because of such dehiscences the ethmoidal cells may communicate with the orbital cavity, the frontal sinus may communicate with both the ethmoidal cavities and the orbit.

Developmental anomalies in the relation between the posterior ethmoidal and sphenoidal cells and the sulcus opticus and canalis opticus are of great importance in connection with the spread of inflammation from these sinuses to the optic nerve. The following anatomical variations have been described by Onodi: The posterior ethmoidal cell forms the medial and inferior wall of the canalis opticus. The right inferior ethmoidal cell is the medial wall of the right canalis opticus, the left ethmoidal cell, the medial and inferior wall of the left canalis opticus and the wall of the left one-third of the sulcus opticus.

The sphenoidal sinus is variable in size and lies in the center of the body of the sphenoid bone. It possesses an anterior, posterior, superior, inferior, and an inner lateral wall. Usually the superior wall is in relation with the roots of the lesser wings of the sphenoid, the foramen opticum, the planum sphenoidale and the sella turcica. Within the latter, lies the hypophysis covered by the chiasma nervorum opticum. That portion of the planum sphenoidale which lies between the chiasm and both optic nerves is termed trigonum presellulare and is usually formed by the superior wall of the sphenoidal sinus; however, it may be partially or entirely formed by one of the posterior ethmoidal cells.

The inferior wall, the floor of the sphenoidal cell, varies in thickness. When the sinus is extraordinarily large, it may be paper thin; usually, except for the posterior wall, it is the strongest. It forms part of the posterior superior roof of the nasal cavity and part of the roof of the nasopharynx. Occasionally there is a fusion of the sphenoidal sinus with the nasopharynx by means of a persistent fetal ductus craniopharyngeus.

The inner wall, the septum intersphenoidale, divides the cells on each side into symmetrical spaces, lying in the midline in sagittal section. The septum may vary in form, shape, and location. One cell may even be entirely absent.

The lateral wall helps to form a portion of the middle cranial fossa and contains the canalis caroticus. It borders directly upon the sinus cavernosus and forms part of its bony wall which may be as thin as writing paper. Numerous minute openings are visible in the bone giving exit to veins which communicate with the cavernous sinus.

The posterior wall is usually strong. It is united by bony union with the os occipitale basilare and may border on the upper portion of the clivus. When the sinus is unusually large, its thickness may be reduced.

The anterior wall contains the natural opening of the sinus, the ostium sphenoidale. Usually this is located in the sulcus extending between the anterior wall and the posterior limit of the ethmoid, the recessus sphenoethmoidalis. However, it may lie medially near the anterior wall or high up under the roof of the nasal cavity. The sphenoidal duct may vary in size from 0.5 to 5 millimeters. It may be a round, oval, half-moon shaped opening or a mere slit. According to Zuckerkandl the anterior wall may be divided into two portions: a smaller medial portion, pars nasalis, and a larger lateral portion, pars ethmoidalis. The anterior wall may form part of the roof of the antrum or the posterior wall of the frontal sinus. When the sphenoidal sinus is very large, the inferior lateral portion of the anterior wall may form part of the fossa ptergopalatina.

The sphenoidal cell may extend to the bulla ethmoidalis and even form part of a common wall with an anterior ethmoidal cell. It may extend into the greater or lesser wings of the sphenoid and posteriorly it may rest against the clivus. Onodi gives the following dimensions of the sphenoidal sinus. Length, between 9 and 60 millimeters; width, about the same; height, between 9 and 42 millimeters. The anterior nasal wall is from 5 to 20 millimeters high and 8 to 28 millimeters wide.

The sphenoidal sinuses may be markedly assymetric. The left sinus may extend over the right to the right canalis opticus. One sinus may be entirely absent. The sphenoidal sinus may border closely upon the anterior, middle or posterior cranial fossa and lie in close relationship to the nerves, vessels, and portions of the brain in these regions. Zuckerkandl has described dehiscences in the lateral wall by which the sinus communicated with the middle cranial fossa. Its relation to the canalis opticus and sulcus opticus is very important. One or both sinuses may form part of the wall of the canalis or sulcus opticus or both. The thickness of this portion of the bony wall of the sinuses is very important in connection with the spread of pathological processes to the optic nerves. Onodi's studies have shown that the wall between the most posterior ethmoidal cell and the canalis and sulcus opticus is usually extremely thin. The wall between these structures and the sphenoidal sinus is more commonly a stronger one. It may vary from paper thin (Berger and Tyrmann, 1) to 7 to 12 millimeters.

In addition to the chiasm and optic nerves the sphenoidal sinus is in direct close relationship in the center of its superior wall with the hypophysis cerebri, with the circulus venosus, and, near its lateral wall, with the carotis interna and sinus cavernosus. By means of excessive enlargements already mentioned, it may come in contact with the following structures: gasserion ganglion, first, second, and third divisions of the trigeminus, with the divisions of the occulomotorius passing through the fissura orbitalis superior, trochlearis, and abducens.

PATHOGENESIS OF INTRACRANIAL COMPLICATIONS

The pathogenesis of the intracranial complications may be subdivided as follows: (1) bacterial infection, (2) predisposing factors, (3) the nature of the cerebral involvement, (4) route of infection,

1. *Bacterial infection.* In mild low grade infections of which mucocele is an example, dilatation of the sinus may occur with atrophy of its bony walls. The mucous membrane may disappear but it does not suppurate. Suppurative infections produce destruction of the mucous membrane and bony structures as well as complications in the orbit and brain.

Most of the cases involving the ethmoidal and sphenoidal sinuses are chronic, less often acute, and in some the duration cannot be determined. In a few cases syphilis is given as the etiological factor.

Bacteria have been demonstrated in normal sinuses. Fraenkel (3) found pneumococci most commonly. Streptococci, staphylococci, and pneumococci are the most common causes of infection. Less commonly, bacillus diphtheriæ, bacillus influenzæ, bacillus Friedlander, and the meningococcus. Bacillus pyocyaneus,

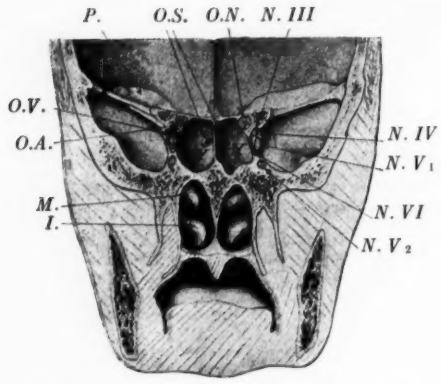

Fig. 6. Frozen section of anterior half of head, cut immediately in front of chiasm. Viewed from behind: *P*, orbital roof of frontal sinus; *O.S.*, ostium sphenoidale; *V V*, right and left sphenoidal cavities; *I.M.*, inferior and middle turbinals; *O.N.*, optic nerve with ophthalmic artery; *O.V.*, ophthalmic vein; *O.A.*, ophthalmic artery. (After C. R. Holmes, Archiv. of Ophthalmology, 1896, 25, p. 467. Prepared from a specimen frozen immediately after death.)

bacillus coli, and anaerobic organisms (bacillus fluorescens, bacillus liquefaciens putridus, diplobacillus fœtidus crassus, bacillus pyogenes fœtidus) have been found. It is not certain that all these organisms are of pathogenic significance. On the basis of bacteriological studies, Stanculéanu and Baup (18) distinguish two types of empyema: (1) With fetid pus, involving the antrum following affections of the teeth. These are produced mainly by anaerobic bacteria (bacillus racemosus, bacillus serpens, bacillus perfringens, bacillus theloide, bacillus fragilis, and staphylococcus parvulus). (2) Those with mucopurulent, nonfetid content which are of nasal origin are usually produced by aerobic organisms (pneumococci, pneumococci and streptococci, pneumobacilli, pneumococci and anaerobes, streptococci alone, or staphylococci alone.

2. Among the important *predisposing factors* may be mentioned congenital defects in the bony walls of the sinuses which have already been considered in connection with the discussion on anatomy. In the case of the ethmoidal sinus defects in the lamina cribrosa may lead to communications between the ethmoidal labyrinth, fissure olfactoria and the cranial cavity. Defects in the superior lateral recesses of the sphenoidal sinus also occur. Energetic and rash operative manipulations may lead to infection of the neighboring cranial cavity, the meninges and brain substance itself.

Stasis of secretion and pus due to an absolute or relative interference with excretion is an important predisposing factor. Acute inflammations cause a hyperæmia and swelling of the sinus mucosa and this frequently leads to an occlusion of the ostium, especially if it is small. In our case the stenosis of the nasopharynx interfered with proper excretion and undoubtedly contributed a share in the production of the intracranial complications.

3. *The nature of cerebral involvement.* In pachymeningitis externa circumscripta in the neighborhood of the bony involvement and its covering dura, the latter loses its gloss, becomes thickened, and discolored. Occasionally pseudomembranous exudates are found, containing masses of granulations. There are extradural abscesses between the dura and bone. There may be an actual bony defect or only a reddened surface, or an intradural abscess, of which pachymeningitis interna is a forerunner. The dura and pia become adherent, later an intrameningeal abscess forms, but usually a brain abscess or diffuse meningitis results as the process practically never stops with the formation of an extradural abscess. Brain abscess is produced by hæmatogenous spread frequently by means of septic thrombophlebitis, extension through the lymphatics or by direct continuity from an intradural abscess.

Localized meningitis occurs with intradural abscess and brain abscess. When this breaks through a diffuse leptomeningitis results. Thrombophlebitis may give rise to meningitis. There may be direct extension from the sinus by means of regional metastases or following operative injury of the dura with infection of the pia.

Thrombophlebitis of the dural sinuses involves most commonly the sinus cavernosus, less often the sinus longitudinalis superior.

Meningitis serosa has been occasionally described in which there is an increased amount of fluid on the surface of the brain. No organisms are found and the condition is due

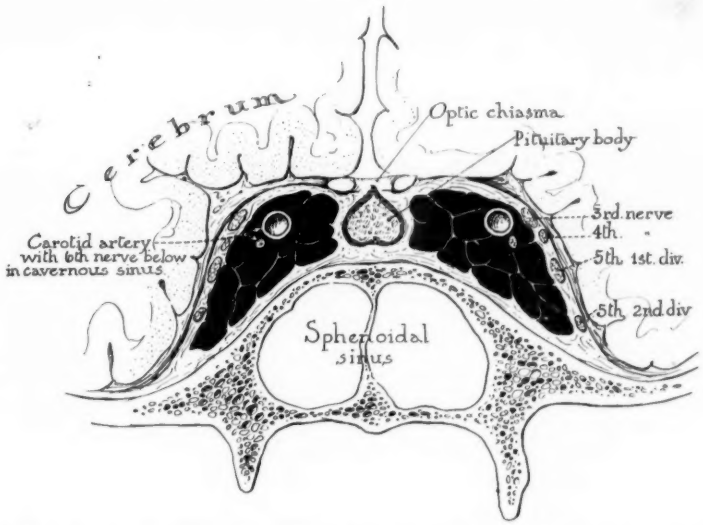

Fig. 7. (Semi-diagrammatic.) Coronal section through sphenoidal sinus, to illustrate immediate relationships with cavernous sinus and its contents, optic nerve, and base of brain. (Thomson.)

to toxic irritation analagous to chemical peritonitis.

4. *Route of infection.* When infection takes place through continuity there is definite macroscopic evidence of pathology in the tissues separating the sinus from the cranial cavity. In other cases complications have occurred but there was no macroscopic evidence of pathology.

The following methods of extension may be considered: extension by direct continuity along the tissues with suppurative softening of the mucous membrane, subperiosteal abscess, and necrosis of bone. The necrotic bone containing pyogenic bacteria, produces on the cerebral side an intradural abscess following which meningitis, cerebral abscess, or sinus thrombosis may develop.

When the tissue separating the sinuses from the cranial cavity are rapidly destroyed diffuse meningitis or sinus thrombosis occurs without the intervention of extradural and intradural abscess. The former is seen following the rapid exfoliation of the lamina cribrosa of the ethmoid, the latter in the breaking down of the roof of the sphenoid and spread of infection direct to the large dural sinuses.

In regional metastases, only a circumscribed reddening of the underlying bone points to the source of infection of an extradural or intradural abscess. Of importance in this connection is the anastomosis between the veins of the sinuses and the ophthalmic vein and dural capillaries.

The ethmoidal sinus is usually involved with several other sinuses and is the last bone to be affected. Thus it may be associated with suppuration in the sphenoidal sinus, the maxillary or frontal sinus. Of 28 cases of intracranial complications of ethmoid sinus disease analyzed by Hajek (8) 12 were acute. The most common anatomical change was caries of the lamina cribrosa, in three the caries was luetic. Where caries did not exist the process was most intense over the ethmoid plate.

The most common complications of sphenoidal sinus infection are meningitis and thrombophlebitis of the sinus cavernosi. Of over 60 recorded cerebral complications studied by Hajek not less than 26 were meningitis either alone or in combination with extradural and intradural abscesses in the region of the sella turcica. Next most frequent is thrombosis of

the cavernous sinus: in 18 cases this was combined with meningitis, in 5 cases it occurred alone. Other complications described are thrombosis of the sinus longitudinalis complicating a meningitis and cerebral abscess. Usually the intracranial complications are of a combined nature.

Infection spreads from the sphenoidal sinus in several ways: (1) By breaking through the diploe. In St. Clair Thomson's (19) study of 42 cases of intracranial complications due to septic infection from the sphenoidal sinus there were 11 in which no macroscopic changes were visible in the bone. (2) By thrombophlebitis of the veins. Sieur and Jacob (17) have shown that the veins of the mucous membrane of the sphenoidal sinuses anastomose with the sinus cavernosi. This accounts for the frequency of thrombosis of the latter. (3) By caries of the bony walls of the sinuses which form part of the base of the skull and are very thin in places. The thickness of the bony wall toward the side of the sella turcica and the upper lateral wall toward the sinus cavernosus is seldom more than 1 to 2 millimeters. In addition there are the bony dehiscences in the lateral upper walls as pointed out by Zuckerkandl in which the mucous membrane of the sphenoidal sinus may lie directly against the dura mater. In a number of cases the process broke through the fossa pterygoidea and infection spread by way of the plexus pterygoideus. (4) By lymphogenous spread which is possible but has never been demonstrated. It is probable that when thrombophlebitis occurs the lymphatics are also involved in the process but this is of secondary importance. In a small number of cases it is impossible to say how infection reached the intracranial cavity.

OPHTHALMIC COMPLICATIONS

The close anatomical relationships between the posterior group of cells and the optic nerve and orbit explains the frequency of extension of inflammatory processes from one to the other. Birch-Hirschfeld (2) reports that almost 60 per cent of cases of orbital inflammation are due to sinus infections. The process may reach the orbit by direct continuity producing periostitis, orbital cellulitis or orbital abscess. In empyema of the posterior sinuses thrombophlebitis of the veins may lead to involvement of the orbit by means of their rich anastomosis. The anterior and lateral walls of the sphenoidal sinuses contain veins which anastomose with the orbit and the ethmoidal venous plexus anastomoses with the dural capillaries.

Injury to the optic nerve may be due to compression of its avascular portion, pressure of the inflammatory exudate upon the central artery of the retina or to direct extension of the suppurative process to the nerve as it passes through the canalis opticus, as in our case. In a careful search of the literature only four cases were found in which there was complete destruction of one or both optic nerves by a suppurative process. The first case was reported by Raymond (16) in 1885 in which the optic nerves, the chiasm, and optic tracts were injected and softened due to infection of the left sphenoidal sinus. The second is a case seen by Professor Elschnig in 1892 and reported by Gradle (6). A carcinoma of the right antrum secondarily infected, had broken through into the orbit and had formed an abscess of the optic nerve. The third case is that of Higgins (9) (1897) in which there was a diffuse meningitis with complete destruction of the optic nerves. The last case was reported by Oeller (14) in 1901, and the changes described were a softening of the optic nerve with interstitial inflammation of the neighboring pia and septa. The acute necrosis involved both nerves at the center of their course through the orbit behind the entrance of the vessels. Clinically the results are first a narrowing of the fields of vision and later amblyopia. In spite of total amaurosis of weeks' duration, the opthalmoscopic picture may remain practically normal, and only later does the papilla show atrophic discoloration, while the retina and papillary vessels are normal. With removal of mechanical pressure, even in high grade amblyopia there may be a return to normal.

The typical ophthalmic condition in posterior sinus disease is retrobulbar neuritis resulting from the direct extension of the process to the optic nerve. The sphenoid and posterior ethmoid sinuses, because of their

close anatomical relation with the canalis opticus most frequently produce visual disturbance. The pathogenesis of retrobulbar neuritis is a toxic involvement of the optic sheath through the passage of material along the perivascular lymphatics in the foramina.

The clinical symptoms are quite variable. Vision may be normal while visual acuity is reduced. The fundus findings may be those of retrobulbar neuritis with temporal pallor and involvement of the maculopapular bundle. In other cases the picture is that of optic neuritis. Occasionally the ophthalmoscopic appearance is that of thrombosis of the central vessels. In acute cases vision may be rapidly lost. In chronic cases the process is slower and may extend over a period of years with intervals in which it is apparently stationary. Changes in the fields of vision of various sorts have been described, including concentric temporal and nasal narrowing, but the most common is a peripheral narrowing. The visual fields, however, may be entirely normal. Various types of scotomata have been described: central, peripheral, ring-like, wedge-shaped, paracentral, and hemianopic. A rather characteristic change accompanying posterior sinus infections according to Van der Hoeve and de Kleyn (21) is an increase in size of the blind spot and at first for color. It is supposed to occur very early when visual acuity and fundus are still normal and for a long time may be the only symptom of posterior sinus disease.

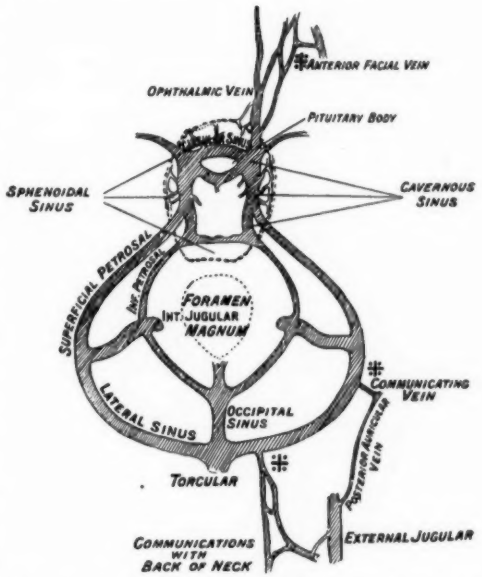

Fig. 8. Diagram to show communication of veins of cavernous sinus with venous sinuses of the cranium; showing also interrelation of transverse and cavernous sinuses with external veins. The asterisks(*) mark the anastomoses of the intracranial venous system with the veins of the surface. (Thomson, modified from Leube.)

THE RELATION OF SYPHILIS TO SINUS DISEASE

In 1886 Berger and Tyrmann (1) stated that the consensus of opinion among rhinologists and ophthalmologists at that time was that caries and necrosis of the sphenoid bone was most commonly due to syphilis. Ten years later Gruenwald (7) saw no reason why a patient with syphilis could not have nasal accessory sinus suppuration. The relation of syphilis to the latter must be proved by histological examination or the therapeutic test when only specific treatment is given. Gerber (4) in 1910 believed that this may be a factor in the production of empyema of the nasal accessory sinuses in the sense that infection is permitted to enter through an ulceration in a turbinate or a broken down gumma in the septum. The bony walls of the sinuses may be the seat of a syphilitic osteitis or periostitis but this is uncommon. Usually the syphilitic process merely acts as a predisposing factor, as in our case, by interfering with proper drainage.

SUMMARY

A case of suppurative posterior ethmoiditis and sphenoiditis with unusual cerebral complications has been described, including a discussion of the normal anatomy of the sinuses and the pathogenesis of cerebral and ophthalmic complications. Such a complete destruction of the optic nerve due to infection alone has never been reported as far as I have been able to learn from a careful search of the literature.

Clinically, the true intracranial pathology was overlooked because attention was focused upon the obvious manifestations of syphilis. The unilateral exophthalmos and primary optic atrophy should have suggested caver-

nous sinus thrombosis, but the patient entered the hospital in the terminal stages when the acute manifestations of nasal infection were forgotten. That they were present and received consideration is evidenced by the fact that the husband of the patient possessed X-ray pictures showing clouding of the ethmoidal sinuses.

Another factor that did not receive sufficient consideration clinically, was the examination of the spinal fluid. In syphilitic meningitis the spinal fluid Wassermann is usually positive and the increased cell count is due entirely to lymphocytes. The negative spinal fluid Wassermann and the fact that the majority of the cells were polymorphonuclear leucocytes should have ruled out syphilitic meningitis.

There was no evidence either grossly or microscopically of syphilitic involvement of the bony walls of the sinuses. The only influence of syphilis upon the pathological condition in this case was the interference with proper drainage produced by syphilitic scars in the nasopharynx.

REFERENCES

1. Berger and Tyrmann. Die Krankheiten der Keilbeinhoehle. Wiesbaden, 1886.
2. Birch-Hirschfeld. Graefe-Saemisch Handbuch der Gesamter Augenheilkunde. Die Krankheiten der Orbita. von A. Birch-Hirschfeld, ix, No. 11, 298.
3. Fraenkel, E. Arch. f. path. Anat., etc., 1896, cxliii, p. 42.
4. Gerber, P. H. Die Komplikationen der Stirnhoehlenentzuendungen. Berlin, 1909.
5. Gowers. Diseases of the Nervous System. 2d ed. Philadelphia: P. Blakiston Sons & Co., 1893, vol. ii, p. 471.
6. Gradle, Harry. Ann. Ophth., 1915, xxiv, 474.
7. Gruenwald. Die Lehre von den Naseneiterungen, 1895, 2d ed.
8. Hajek. Pathologie der Entzundlichen Erkrankungen den Nebenhoehlen der Nase. Leipzig und Wien: Franz Deuticke, 1915, 4th ed.
9. Higgins. Brit. M. J., 1904, ii, 1286.
10. Kuhnt. Ueber die entzundlichen Erkrankungen die Stirnholen und ihre Folgezustande. Wiesbaden: 1895.
11. Lapelle. Arch. internat. de laryngol. etc. 1899. Quoted by F. Martin.
12. Martin, F. De la frequence de l'empyeme des cavites accessoires du nez. Paris: Masson, 1900, p. 304.
13. Onodi. Handbuch der speziellen Chirurgie des Ohres und der oberen Luftwege. i, p. 89. Katz, Preysing and Blumenfeld. Wurtzberg, 1913.
14. Oeller. Festschrift zum 80. Geburtstage vom Prinzregenten Luitpold. Quoted by Birch-Hirschfeld.
15. Pitt, Newton. Brit. M. J., 1890, i, pp. 643, 771, and 827.
16. Raymond. Bull. et mém. Soc. anat., 1885, x, 226.
17. Sieur and Jacob. Recherches anatomiques, cliniques, et opératoires, sur les fosses nasales et leurs sinus. Paris: 1901.
18. Stanculéanu and Baup. Die Bacteriologie des Empyems der Nebenhoehlen der Nase. Opth. Sekt. d. 18 Internat. Kongr. zu Paris. Arch. f. Augenheil. 1900, xlii, 219.
19. Thomson, St. Clair. Cerebral and ophthalmic complications in sphenoidal sinusitis. Tr. London M. Soc., 1906, xxix, 12.
20. Treitel. Berl. klin. Wchnschr., 1896, li, p. 1139; Ztschr. f. Ohrenheilk., 1895, xxvii, 32.
21. Van der Hoeve and de Kleijn. Arch. f. Augenheil., 1910, lxvii, 101; 1909, lxiv, 18. Arch. f. Ophth., 1910, lxxv, 513.
22. Wertheim. Arch. f. Laryngol. u. Rhinol., 1900, xi, 169.
23. Yerger. Illinois M. J., 1921, xl, 395; ibid, 1923, xliii, 304.
24. Zuckerkandl. Normal and Pathological Anatomy of the Nasal Sinuses. vol. 1, 2d ed., 1893.

A DEVELOPMENTAL ANOMALY OF THE PATELLA FREQUENTLY DIAGNOSED AS FRACTURE

By JOHN D. ADAMS, M.D., F.A.C.S., and RALPH D. LEONARD, M.D., Boston

WHILE nothing new in the light of fact is offered in this contribution, it is presented with the idea of bringing to the attention of surgeons, particularly those interested in industrial accident work, the importance of a correct diagnosis of fractures of the patella.

The patella is a true sesamoid bone, and like sesamoid bones in other parts of the body it is subject to anomalies in its development. It is generally agreed that lime salts are first laid down in the patella from the fifth to the sixth year. The patella usually develops from one center of ossification, although various investigators have stated that it occasionally develops from two centers. Even when arising from two centers of ossification, the fully developed patella is usually a single bone. Rarely, it is found to consist of two or more bones.

In 1902, Joachimstal was the first to describe the particular anomaly of the patella wherein the patella consists of two or more separate bones (Fig. 4). Other authors, particularly Kohler, in the third edition of his book, *Grenzen des normalen und Anfange des pathologischen im Roentgenbilde* describes this anomaly. One or two others, both English and French writers, have mentioned a similar condition.

Mouchet reports one case calling attention to the condition here described and also mentions observation done on the cadaver.

Moreau reports three cases of a similar condition.

Reinbold publishes a report of four cases.

Todd and McCally present a long and very exhaustive article on anomalies of the patella resulting from work done on the cadaver and mentions this condition in conjunction with defects in the patella margin.

In our own experience, during the last 5 years six of these cases have come to our attention. Four out of the six had been diagnosed erroneously as fractures. And it is for this reason that we feel that it might be helpful to call the attention of the profession to this anomaly.

Both in the literature and in our own experience, all cases of this anomaly present the same X-ray appearance (Fig. 1). The outer and upper quadrant of the patella, the portion which is always involved, may consist of one or two separate fragments of bone. The general contour of the patella is not distorted. The separate fragment of bone has the same structure as the main portion of the patella. It is entirely surrounded by cortical bone, the mid-portion resembling normal cancellous bone. The outer and upper surface is curved,

Figs. 1 and 2. Roentgenograms showing anteroposterior and lateral views of bilateral congenital anomalies of the patella. Case 1.

Fig. 3. Anteroposterior view of the knee in Case 2.

the inner surface which is contiguous with the main portion of the patella is flat, or in the anteroposterior view appears as a straight line. There is a definite space between the adjacent surfaces of this fragment, which is about one-sixteenth of an inch in width and uniform throughout its entire length. This separated fragment may occasionally itself be divided into two parts, the periphery of both portions consisting of cortical bone, the adjacent margins being straight with a smooth outline. In our experience, this developmental anomaly is found in a great majority of cases to be bilateral. In our series of six cases, five were bilateral. This is the experience of both Kohler and Joachimstal.

The counterpart of this patella anomaly is found in one of the sesamoid bones beneath the head of the first metatarsal. It is very commonly observed that this bone which normally is a single bone, may develop in two parts. The structure and relation of these bi-parte sesamoids of the great toe are identical with the structure and relations of this congenitally divided patella (Fig. 5).

Fractures of the sesamoid bone may occur. The appearance seen in the X-ray differs from the figure here shown in that the edges of the fragments are irregular and serrated, having the characteristic appearance of fragments in any fresh fracture.

Fractures of the patella may result from direct violence. When due to direct trauma, fractures may be of a stellate character without much displacement, the capsule remaining intact. We also find simple linear fractures running vertically or in any of the other diameters as the result of direct violence. One rarely finds an oblique fracture of the edge of the patella in the location of this congenital anomaly. Many fractures of the patella are due to indirect violence, in which unusual stress is put on the quadriceps muscle and the patella tendon. The patella being at the fulcrum, against the resisting surface of the femur, is fractured instead of the tendon of the quadriceps becoming ruptured. In these fractures due to indirect violence the line of fracture is usually of the simple linear type, running transversely across the patella. Frequently, there is rupture of the capsule with varying degrees of separation of the fragments.

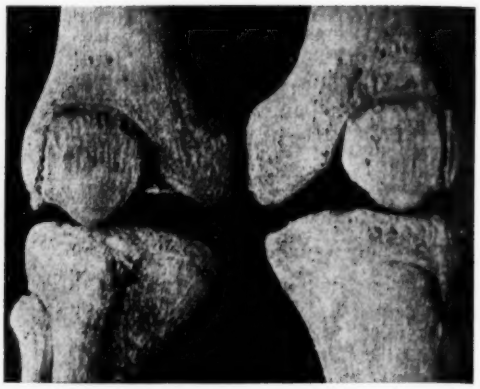

Fig. 4. Congenital anomaly of patella reported by Joachimstal.

Fractures of the patella, are, of course, accompanied by a definite history of trauma and with the usual clinical manifestation of bone injury.

Fig. 5. Sesamoid beneath head of first metatarsal showing a congenital variation in that it is divided into two parts.

A differential diagnosis between this developmental anomaly and fracture may possibly be made first, by a difference in the outline of the fragments.

As we have stated previously, the outline of a congenital fragment is smooth and consists of cortical bone, whereas a fracture shows a more or less serrated edge and involves cancellous bone. Second, the location of a linear shadow helps to determine whether a fracture is present or whether it is only a congenital variation. It is rare to find fractures in the outer and upper quadrant of the patella, which is always the location of the congenital anomalies. Third, the congenital anomalies are not accompanied with the usual clinical story found with real fracture. Fourth, the most important congenital anomalies are nearly always bilateral and a radiogram made of the knee frequently is all that is necessary to make a positive differential diagnosis.

The correct diagnosis of abnormal conditions of the patella on general principles is naturally desirable, but it is of particular importance from the standpoint of the industrial accident cases for economic reasons, if for no other.

Three cases coming to our attention during the past year were examined by us for the Industrial Accident Board. This Board, during the same period of time, examined sixty-three cases of fractured patella. Included in these sixty-three cases were our three cases of congenital anomalies, incorrectly diagnosed as fracture.

In this brief series, we find an error of 3.17 per cent. Two of these cases have been under treatment for many weeks as fractured patellæ. The erroneous diagnosis in these cases represents a needless economic loss to the patient, insurance company, and indirectly to the community.

The following three cases are typical illustrations of this condition:

CASE 1. Male, age 36; injured October 29, 1924. The injury was comparatively trivial. While scooping up some gravel his foot slipped and he struck the handle of the shovel that he was using. The patient continued work during the day, complaining of slight discomfort in the patellar region. The next day he was X-rayed and an erroneous diagnosis of fracture made from the X-ray film. The patient has been under the usual treatment for fractured patella ever since. The doctor states that the patient should be able to return to work in a few days from now, "February 24, 1925." Examination which was made by us of this patient on January 7, 1925 (Fig. 1), shows the typical congenital developmental anomaly which is bilateral. There is no evidence of fracture. The patient's prolonged disability, of course, is due mainly to fixation plus a certain amount of mental unwillingness to return to work.

CASE 2. Male, age 21. On December 24, 1924, he stepped back to avoid a loaded truck; his foot slipped through the edge of an open elevator wall, and he twisted and struck his left knee. Patient was seen 3 hours after the accident. Examination showed a badly swollen and discolored knee with the joint full of fluid. A ham splint was applied. Forty-eight hours later an X-ray was taken. The condition in upper quadrant suggested a second film which was taken of both knees (Fig. 3). A plaster cast was applied and removed at the end of 10 days. The joint then was free from fluid. Patient had a normal convalescence. He returned to work January 24, 1925, 4 weeks following injury.

CASE 3. This is a case of an industrial worker who sustained an injury to the knee joint while at work. As in the two previous cases, patient came under the compensation law and was passed upon as being compensable. A diagnosis of fracture was made. The X-ray showed a picture comparable to that of Cases 1 and 2. Unfortunately, it has been impossible to obtain a print of this picture.

A survey of the cases of fractured patellæ which passed before the Industrial Accident Board for consideration shows a period of disability of about 5 months.

The ever increasing number of industrial cases entailing an economic loss to industry and financial depletion to the patient, in addition to compensation paid by insurance companies, demand the highest standard of precision of diagnosis.

CONCLUSIONS

1. Congenital anomalies of the patella are more common than has generally been supposed.

2. In our series of sixty-three cases of fractured patellæ during one year, over 3 per cent were congenital anomalies erroneously diagnosed as fractures.

3. The differential diagnosis between a congenital anomaly and fracture can easily be

made from an X-ray film. (a) These deformities are usually bilateral. (b) The adjacent surfaces of the bones are smooth and consist of cortical bone. (c) The congenital anomalies are located in the outer and upper quadrant, which is a rare location for fracture. (d) The absence of a typical clinical history and the symptoms usually associated with fracture should make the examiner suspicion that he is dealing with a congenital anomaly.

4. The recognition of the possibility of this congenital anomaly is important for economic reasons, if for no other.

BIBLIOGRAPHY

JOACHIMSTAL. Ueber Struktur, Lage und Anomalien der menschlichen Kniescheibe. Arch. f. klin. Chir., 1902, lxvii, No. 2.

ALBAN KOHLER. Grenzen des normalen und Anfange des pathologischen im Roentgenbilde. 1920, 3d ed.

MOUCHET, A. Anomalies d'ossification de la rotule. Bull. et mém. Soc. anat. de Paris, 1914–19, lxxxix, 452.

Idem. Osteite de croissance de la rotule. Bull. et mém. Soc. de chir., Paris, 1919, xlv, 1215.

MOREAU, L. Les fractures meconnues de la rotule. Presse méd., Paris, 1920, xxviii, 374.

REINBOLD, P. La rôle anomalies d'ossification de la rotule dans le diagnostic de lesions traumatique de genou. Rev. méd. de la suisse Romande, 1917, xxxvii, 653.

TODD, T. WINGATE, F.R.C.S. (Eng.), and MCCALLY, W. C. Defects of the patellar border. Ann. Surg., 1921, lxxiv.

INGUINAL HERNIA AND OPERATIVE PROCEDURE[1]

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TO assist me in making what I have to say clear, I will narrate the following little allegory.

Once upon a time in an era that need not be specified, 2 sea captains were discussing what was at that time a vexed question: the shape of the earth. Said the first mariner (whom we shall call A), "Flat, of course; why not? An old friend who knew a great deal about such things told me so many years ago; I myself have been for 30 years trading between Europe and the East, and I always take care to come back by the way I went, lest I should go over the edge of the World."

Then Mariner B.—"Nay, you are surely mistaken. For 30 years I too have been trading between Europe and the East, but instead of returning by the way I went I have always continued on my easterly course, which brings me back to Europe again. The earth must therefore be a spheroid and not a flat surface. Incidentally my experience has brought to me knowledge of countries and peoples of whom you know nothing, and possibly you may care to hear something about them."

This simple little allegory will, I believe, be helpful to me in making clear one or two points, more especially with reference to "procedure." Note in the first place that the enormous gain in knowledge, and doubtless in material profit enjoyed by B., was derived from and entirely dependent upon his "procedure." A.'s procedure on the other hand is incapable of teaching him anything, and so long as he persists in it he will remain steeped in ignorance and content.

Now comes the interesting question, what will A. do? The following courses are open to him, and great issues (for him) will hang upon his decision.

1. He may frankly accept the new knowledge, and at once adopt the new and highly advantageous "procedure."

2. He may express himself as convinced by the logic of B.'s arguments and by his procedure; but prefers to go on sailing to and fro between Europe and the East, because he has got along very well that way hitherto, and he feels moreover that it is "on the safe side."

3. He may simply disbelieve B.

Now I intend to show that in the choice of procedure for the cure of inguinal hernia, surgeons are in the position of having to choose one of three courses exactly analogous to those set forth above for the mariner; and the worst of it is that the enormous majority have chosen the second course, with the result that they fling away all the advantages offered by the first, including the essential knowledge of the precise nature of hernia.

Let me now, instead of two mariners, suppose two surgeons A. and B. who started 30 years ago operating for the cure of hernia. Both had been trained in the theory of hernia universal at that time, viz., that hernia was typically caused by muscular weakness, that it might appear either internal or external to the deep epigastric vessels, that it might also sometimes enter an open funicular process, and that it was a thing of curious and puzzling variations, and so on; an unintelligible muddle in fact with a go-as-you-please nomenclature in accord.

We may suppose that A. and B. each operate upon an ordinary case of oblique inguinal hernia, the two cases being precisely similar in every respect. A. does an operation involving of course removal of the sac, followed by some suturing method. B., on the other hand, for reasons of his own, is content with removal of the sac alone. In both cases complete and permanent success follows. Now are we to conclude that both methods are equally right because the results are identical? As well maintain that both our mariners were equally right in their procedure because they both got to and fro between Europe and the East. Surgeon A. will have learned nothing but will be simply confirmed in his erroneous beliefs as to the causation of hernia. B., on the other

[1] Address to the County of King's Medical Society, Brooklyn, New York, October 22, 1924.

hand, will have gained knowledge of the startling fact that it was the sac and not muscular weakness that had been the cause of the hernia in his case; clearly the muscles were in no way at fault or there would infallibly have been recurrence. A. and B. go on operating until they have each operated on say 1000 cases of inguinal hernia of all varieties. From this experience A. will have learned nothing worth knowing, and for this he has to thank his "procedure," and nothing else; he will, it is true, have discovered that the results of his operations are vaguely precarious, that for some reason they sometimes fail, why, he does not know. The removal of the sac with him is merely an incident of the operation, the stitching is the thing; and his ambition is to devise some ingenious and fanciful way of suturing the muscles that will do away with recurrences, and perhaps shed lustre on his name (for a time).

Let us now turn to B., who with opportunities for observation in no way superior to those enjoyed by A. has arrived at conclusions that place him in a very different position. He has learned a great deal about inguinal hernia that he never suspected when he began; and here are the main and most instructive facts:

1. Spontaneous hernia is of two kinds: saccular and non-saccular.

2. In saccular hernia, removal of the sac will cure the hernia; in non-saccular hernia removal of the sac is useless.

3. The typical forms of saccular hernia are (a) oblique inguinal, (b) femoral, (c) a rare form of direct hernia that enters a small congenital sac coming through the conjoined tendon. (d) Probably all other varieties of spontaneous hernia with the exception of ordinary direct hernia.

4. The typical form of spontaneous non-saccular hernia is the ordinary direct hernia of middle and later life; this must be carefully distinguished from 3, c.

So that the distinction between oblique and direct inguinal hernia is wide as the poles; it is clearly not a matter of the hernia coming down inside or outside the deep epigastric vessels by any sort of mere chance. Oblique hernia is always saccular and is never due to muscular weakness; inguinal hernia that is really due to muscular weakness is always direct, and "ordinary" direct hernia is always due to muscular weakness.

Now all this important knowledge that has become a matter of commonplace observation with B., has been entirely missed by A. who has been the helpless victim of his own procedure. For years he has gone on operating for "inguinal hernia" (as though inguinal hernia were a uniform entity) by his suturing method, drawing entirely wrong conclusions both as to the causation of hernia, and the reasons for his own successes and failures; always believing that oblique inguinal hernia is mainly due to muscular weakness, and believing he is curing his patients by his clever suturing; noting that for some reason he does not understand direct hernia seems more refractory to cure than oblique, and being content with that observation, about which B. could have enlightened him; missing his opportunities in fact exactly as did the mariner who was content to go to and fro rather than circumnavigate the earth.

It is idle to argue for one moment that suturing up the canal does no harm; it does immense injury both to the surgeon and in the aggregate to the patients. Look at it from a logical standpoint and as affecting the patient only. I have said, and it is beyond question true, that oblique inguinal hernia is never caused by muscular weakness; therefore the muscles are perfectly efficient to prevent the return of hernia when the sac is removed. Given, then, perfectly adequate (or at any rate sufficiently adequate) muscles, are we to suppose that they are likely to be improved, strengthened and made more adequate by stitching them firmly down to Poupart's ligament? When put in that way the procedure suddenly seems laughable, does it not? And it is truly ridiculous. Moreover, it has been abundantly shown by experience that surgeons who operate by a suturing method do not acquire the art of removing the sac with nearly the same completeness as those who operate by removal of the sac alone. The fact that surgeons who operate by suturing methods rarely, if ever, remove the sac completely is shown in a peculiarly exasperating

way when they decide to "*give simple removal of the sac a trial.*" The "trial" always results in failure because they remove the sac in the way they have been accustomed to remove it, which is an imperfect way; so they go back to their suturing methods, having done more harm than good. From this it would appear that the suturing is apparently of some use when the first stage of the operation has been ineffectively performed; it must be regarded therefore as a means for repairing the surgical deficiencies, rather than for repairing the hernia. Now I do not wish to give you only a mass of destructive criticism, which is always more or less easy. Let me try to be constructive and give you something that will be of positive and direct help in the performance of an operation for oblique inguinal hernia as I want you to do it. We will assume that you have already started on your operation and have got as far as exposure of the canal by incision of the external oblique, and that you have found and are beginning to isolate the sac. Now

1. Seize the sac in a pressure forceps and pull it forcibly out; strip the structures of the cord completely away from the sac and abdominal peritoneum, and this involves working deeply in the abdomen; free the neck of the sac by sweeping the finger all around it.

2. Twist the sac tightly up until practically you can twist no more, pulling forcibly upon it all the time. This will insure that the entire sac will be torsioned up to the point where it comes off from the abdominal peritoneum, and it is at this point that the ligature must be applied.

3. Do not transfix with a needle; apply a "crusher" of some sort to the spot where the ligature is to go; below the crusher throw the ligature (catgut always, never silk) which will slip into the crush as the instrument is taken off.

4. Nothing more will remain to be done, except to repair the incision in the external oblique. Personally I prefer to do this by merely including it in one or two of the stitches employed for closure of the outer wound.

I attach great value to the tight torsioning and forcible pulling on the sac; also to non-transfixion, and the use of catgut always as a ligature.

In conclusion I should like to give you a few facts of interest about the subject of hernia in general and in particular about the causes that have brought me here this evening. It is all traceable to so far back as the year 1891 when I was appointed a surgeon to the Children's Hospital in Melbourne. At that time our guiding principle was based on the theory that hernia in childhood was often curable by the use of a truss and that operation should never be undertaken until truss treatment had been patiently tried. As to the exact indications for operation and the nature of the procedure to be carried out, the surgeon had a wide range of choice and was practically fancy free.

As to the nature and causation of hernia, it was vaguely regarded as being of the nature of "rupture" or giving way of the muscles; at the same time it was recognized that the processus vaginalis might play a part by providing a pre-existing sac for the hernia to descend into. Where the processus vaginalis was completely open from abdomen to tunica vaginalis testis there could be no mistake as to the nature of the sac of the hernia; but where the funicular process had been partially obliterated so that the tunica vaginalis testis was shut off, the hernia could not then be distinguished from the ordinary "acquired" hernia of tradition. In other words there were two varieties of oblique inguinal hernia radically opposed in origin and nature, yet practically indistinguishable from one another. But if these two totally different varieties were indistinguishable what conceivable ground could there be for believing that both of them existed; why should they not be all of one kind or all of the other? Clearly there could be only one way of differentiating between the two kinds, viz., to remove the sac and see what happened. Any individual case of hernia that was of the traditional acquired type due to muscular weakness would be practically unaffected by removal of the sac, and would infallibly recur; on the other hand, if recurrence did not take place that would be clear proof that the sac must have been the cause of the hernia. It was very soon learned

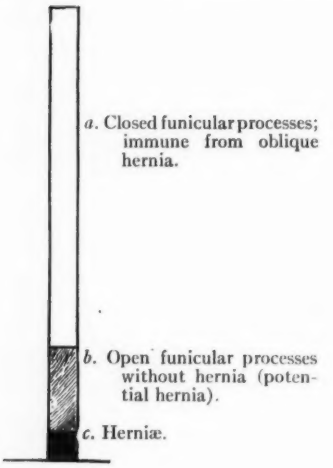
a. Closed funicular processes; immune from oblique hernia.
b. Open funicular processes without hernia (potential hernia).
c. Herniæ.

Fig. 1. Diagram representing the funicular processes of any given number of people.

at the Melbourne Children's Hospital that all inguinal hernia in childhood is funicular in origin, and that the acquired form is non-existent. Consequently we were enabled to revise our entire theory and practice in children's hernia. The accompanying simple diagram will help to make the matter clear (Fig. 1).

The column represents the funicular processes of any given number of people; in at least 10 per cent of people at a moderate estimate one or both funicular processes are imperfectly obliterated, leaving the conditions ready for the occurrence of hernia, so we shade the lower one-tenth of the column to indicate the open funicular processes. Thus we have an upper nine-tenths of the column representing children immune from hernia, and a lower one-tenth representing those predisposed, the subjects of "potential" herniæ. Now 2 per cent of children get inguinal hernia, and these we place provisionally in the predisposed category. If we contemplate this diagram, we arrive inevitably at the following momentous conclusions:

Male mankind is divisible according to the diagram into three groups:

1. With perfectly closed funicular processes (immune from oblique inguinal hernia).

2. With open funicular processes, without hernia (predisposed to hernia).

3. With open funicular processes with hernia.

Now we were able to make an exact estimate of the value of truss treatment which had always been our sheet anchor; and we saw that the utmost that could be achieved after a most laborious and uncertain course of treatment was to transfer the child from Class 3 to Class 2; whereas removal of the sac could alone and at once transfer him to the most desirable category, Class 1. To make a long story short this reasoning proved to be right in every particular and for a great many years past, the truss has fallen into complete disuse at the Melbourne Children's Hospital. I am unable to say whether there is any other Children's Hospital in the world where this is so, but so far as I can gather I am disposed to doubt it.

Thus we regard hernia in a child as a defect remediable by removal of the sac, and not properly speaking remediable in any other way, and every child without distinction of age that is brought with a hernia has the sac removed as a matter of course. There is nothing more striking than the way in which an ill-nourished, constantly screaming infant with double inguinal hernia will be transformed into a comfortable prosperous baby immediately after the double rupture has been operated on. Finally, having arrived at this point through experience gained in work among children, in the year 1901 I was suddenly transferred to the staff of a general hospital, and you may imagine with what interest I scrutinized the herniæ of the adults who now came into my hands. Let me say at once that there is no etiological difference between the hernia of children and the hernia of adults; oblique inguinal hernia in adults as in children is never anything except funicular in the male, and it is cured by removal of the sac, if it is efficiently done, just as surely in the adult as in the child. Direct hernia (the ordinary form) is an affection of middle and later life mostly, and is of course not seen in childhood; the rare saccular form of direct hernia (*vide supra*) might, no doubt, occur in childhood, but I have never met with it. For

the rest, the main differences will be those due to long duration of the hernia in the adult with stretching of the musculature. In special cases of this kind the surgeon may think it wise to do a little suturing of the musculature; but he will find his inclination to do this decline with experience when once he has acquired the habit of a sound method of operating by removal of the sac alone. In conclusion I would point out that whereas one is accustomed to look upon knowledge as an essential preliminary to "procedure," in this particular matter of hernia it would seem that knowledge of hernia is dependent upon and comes after "procedure," and this is so. Unless surgeons make up their minds to alter their procedure, abandoning altogether all forms of suturing operations for oblique inguinal hernia, they will never distinguish between the saccular nature of oblique hernia and the non-saccular nature of direct hernia. And that distinction fully grasped is the basis of all real understanding of the problems presented by every form of hernia, wherever occurring.

I have some regret that time will not permit me to do more than allude to the other most important form of saccular hernia—the femoral variety; in this the sac is formed by inclusion of a peritoneal pouch in the sheath of the femoral vessels. The direct evidence in favor of this is clear and to my mind completely satisfying, and its recognition is of the utmost importance. The practical deduction is that none but the simplest form of technique for removal of the sac should be attempted here, for there is no friendly musculature to cover up surgical errors, as is the case with the inguinal region. My object in this address has been to sound an alarm; and let me say that I myself feel profoundly alarmed. What I have seen of late convinces me that in the matter of hernia we have practically stood still for the last 30 years; and that neither the operative treatment nor our theoretical grasp of the nature of hernia has advanced materially. And the reason for this? In one word —"procedure." Surgeons must alter their procedure in the way I have indicated; must give up treating oblique inguinal hernia by any means other than simple removal of the sac without suturing. Unless this is done there will be no more advance in the next 30 years than in the past; and until it is done there will be no advance at all. I am glad to have the opportunity of saying this to American surgeons, not merely because I myself hope to have the honor this week of becoming an American surgeon, but even more with the assurance that what I have said will appeal to minds that are reputed, and rightly reputed, to be notable for openness and receptivity and independence. I shall probably never operate for hernia again, but I must devote whatever time and energy may be left to me to a crusade in favor of a revised and correct procedure. And may I, in conclusion, tell you this once and finally at the risk of overemphasising the message I have come with. If you want to learn all that there is to be learned about hernia, you will find that the key to the problem or series of problems is to be found in the operation for oblique inguinal hernia. You will be amazed at the revelations that will pour in upon you not only with respect to the different varieties of inguinal hernia, but of other forms of hernia as well. For one thing, you will soon come to smile at the thought of femoral or obturator hernia being anything other than of saccular origin, and the knowledge gained is sure to lead you to the simplest and the most perfect operative methods.

THE PERSISTENT OR PREFORMED SAC IN RELATION TO OBLIQUE INGUINAL HERNIA

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THE subject of inguinal hernia has been studied exhaustively in the past 20 years, and the principles involved in its causation and treatment are now so well established that further discussion of the subject would seem to be rather unnecessary. However, careful search of the literature fails to reveal any mention of an observation which has been made repeatedly in this clinic during the past year and which seems of sufficient importance to warrant recording.

The patient presenting a well developed unilateral oblique inguinal hernia and a so-called relaxed external inguinal ring on the opposite side is a well recognized entity to every general surgeon. And it has been a fairly universal practice to advise these patients to have the relaxed ring repaired at the same time that the herniotomy is done. During the repair of such a relaxed ring, casual search is made for a hernia sac, but with surprising regularity this search has been fruitless.

In speaking of a relaxed external ring reference is made only to those cases in which the ring is abnormally large—that is, readily admits the examining finger—and in which palpation of the canal fails to reveal any evidence whatever of a peritoneal sac, such as an impulse on coughing, etc. The improperly called potential hernia is not to be considered.

During the past year a number of these cases, 12 in all, have been operated upon, and during the repair of the relaxed ring very careful search has been made for some evidence of peritoneal protrusion through the internal inguinal ring. In every instance this sac, whether just beginning to form or whether a persistent or preformed structure, has been found.[1] A detailed description of the general character of the structures forming the inguinal canal in such a case and the size and position of the sac may be of interest. Following the incision of the skin and the clearing of the external oblique aponeurosis, the external ring is usually found to be about 2 centimeters or more in diameter, and, a point which must be emphasized, quite frequently the fibers of aponeurosis exhibit a perfectly definite separation of a more or less marked degree extending down to the dilated ring (Fig. 1). This condition is almost constant in all definitely formed herniæ in which the sac has passed into the scrotum. We have here, therefore, an anatomical separation of these fibers for which we can give no adequate mechanical explanation, as there has never been present a sac as the factor concerned in stretching the structures of the canal. As the incision is carried through this split in the aponeurosis, and the inguinal canal proper is exposed, the structures there all have a perfectly normal appearance. The cremaster muscle is usually thin and delicate rather than hypertrophied as is so often the case when it has had to support the contents of a large hernia sac, and the cord shows no evidence whatever of any beginning sac, at least in that portion visible below the edge of the internal oblique muscle. As the cord is lifted up from its bed and the internal oblique is retracted, the region of the internal ring is exposed and this beginning sac, referred to above, comes into view lying anterior to the funiculus in close relation to and often following the form of the angle made by the spermatic artery and cord as they emerge from the pelvis. The sac may be 1 or 2 centimeters in length and its base usually 1 to 1.5 centimeters in diameter; in shape it is usually triangular. It may or may not contain omentum, but at this stage is, of course, too small to contain bowel. It is not formed by tension on the cord as complete relaxation of the cord, once the sac has been found, will cause no change whatever in its size, relations, and position (Fig. 2). In other words there is in these cases a perfectly definite sac present, whether it be acquired or

[1] Dr. J. M. T. Finney tells me that he has never failed to find this sac under circumstances similar to those described above.

whether it be a persistent or preformed structure, these latter appellations indicating, of course, a congenital origin.

The actual etiology of such a sac is a matter of interest and must bear some relationship to the general etiology of all indirect inguinal herniæ. In 1817, Jules Cloquet said that the internal ring rarely closed at birth and that he had found in dissections a depression of peritoneum which he called "the infundibular process of peritoneum."

Much has been written on the subject of this persistent infundibular process of the peritoneum; notably, Russell (7, 8), who has published many articles on the sacular theory of the formation of hernia. His ideas are summed up in the following way. "By the sacular theory of hernia, I mean, the theory that rejects the view that any hernia can ever be acquired in the pathological sense and maintains that the presence of a developmental peritoneal diverticulum or sac is a necessary antecedent condition in every case of abdominal hernia." In his specific reference to inguinal hernia, he lists the following probable causes: "(1) variations due to obliterative failure, (2) primary anatomical variations due to developmental accidents, and (3) developmental accidents resulting in the implication of an abdominal organ in the formation of the funicular process." And in relation to the muscular development of the abdominal wall he further says: "We may have an open funicular peritoneum with perfectly formed muscles, we may have congenitally weak muscles with a perfectly closed funicular peritoneum, and we may have them separately or together in infinitely variable gradations."

During the past year, Sir Arthur Keith (6) has published a paper which is largely devoted to the refutation of Russell's ideas. He feels that there is no evidence whatever from an embryological standpoint for the theory of the preformed sac. This argument in regard to herniæ other than those under consideration need not be discussed, but there can be no denying the fact that at the internal inguinal ring there is the possibility of a persistent congenital structure. What the factor is that causes further development of this sac into a definite clinical hernia is also of slight concern, but the mention of a few theories might be made. Keith says that it is not "continued degrees of high intra-abdominal pressure, but minor and oft repeated impulses that produce the hernia." He also refers to the "inguinal shutter" which is formed by the muscular contraction of the anterior wall of the canal.

Hammond (4) explains the onset of hernia in a preformed sac as due to an acute incoordination of the muscles constituting the so-called "sphincter of the internal inguinal ring"; this occurs in strains, etc., some viscus descending into the sac during this momentary period of relaxation. And Russell feels that the normally formed inguinal canal is endowed with a strength and retentive efficiency for resisting hernia enormously in excess of any demand that can be made upon it by the mere intra-abdominal pressure unaided by the presence of a sac.

The actual frequency of occurrence of this preformed sac is rather difficult to estimate; some figures, however, are available which may bring light on the subject. Most of these figures have been derived from studies made on the cadaver. Row, examining 200 subjects, found 47 "potential herniæ." Keith found 120 in a thousand examinations of the inguinal canal in old individuals. Various other studies have shown an average occurrence of about 20 to 30 per 1,000 cases examined. It must be further emphasized that this determination cannot be made simply by examination of the living subject. These preformed sacs are not clinically demonstrable; therefore, aside from the cases actually demonstrated at operation, further evidence of their occurrence must be gained more or less by inferential methods.

Taylor (10), in a study of the results of operations for inguinal hernia performed over a period of about 20 years at the Johns Hopkins Hospital, re-examined carefully 184 out of a total of approximately 1000 cases. Of those cases which he re-examined personally, and which had originally presented a unilateral inguinal hernia and undergone operation for its cure, 29 (16 per cent) at a later time showed the presence of hernia upon the opposite side. As has been said above, such evi-

dence is purely inferential, but in the light of the observations here recorded, would seem to be pertinent to the subject under discussion. In a few of these cases which later showed a hernia on the opposite side, note was made at the time of the original examination of the dilated inguinal ring. Coley (1) reports that it is an almost daily observation at the Hospital for Ruptured and Crippled to find patients applying for operation or truss on one side, when careful examination shows hernia on the other side almost, if not quite, as large as that for which treatment was sought. This is, of course, a common experience in any surgical clinic and is of importance in consideration of the occurrence of double inguinal hernia. Erdmann (3), in an analysis of nearly 1,000 cases, found that approximately 12 per cent of unilateral hernia cases returned at some later period for operation upon the opposite side. Twenty-five per cent of his cases originally showed bilateral inguinal hernia, a surprisingly large proportion. These two figures therefore would make a total of 37 per cent of his cases exhibiting at some period in their course of hospital observation a hernia upon each side. It is reasonable to assume, therefore, that the bilateral inguinal hernia is a condition of frequent occurrence whether both herniæ are present at the same time or not.

What bearing can the facts put forth have upon the operative treatment of hernia? Seelig and Chauke (9) say that nothing is pertinent in the operative treatment of hernia except "(1) high ligation of the sac, (2) adequate reinforcement of defective abdominal wall, and (3) primary wound healing." These criteria would probably meet with fairly universal endorsement. Here again, however, there is a definite difference of opinion in regard to the most vital part of the whole procedure. Russell, convinced of the importance of the preformed sac, is content in his operations simply to excise carefully and thoroughly the hernia sac when found, thus restoring the normal tension of the parietal peritoneum. He feels that the measures used to strengthen the inguinal canal are not essential and presents impressive figures to support his views. However, he regards the absence of symptoms for 1 year as evidence of cure. This period of absence of symptoms is obviously not long enough. In contrast to this opinion, no case has been found showing a recurrence in which the inguinal canal has been strengthened as a result of finding a dilated ring, although either no attention is paid to the possibility of a sac, or else none was found when sought for. Admitting the probability of the presence of a sac in all of these cases, we would have prevented under such circumstances the occurrence of a hernia without paying any attention to the presence of the sac itself. Data on this point, however, are not sufficiently reliable to warrant drawing any definite conclusion, and the combined procedure of excision of sac with plastic treatment of the inguinal canal must continue as the operation of choice. In other words, if anything is done, it should be the complete hernia operation.

The advisability of urging the patient to undergo the combined operative procedure when only one hernia is present but when there is a dilated ring on the opposite side, is open to question. This must be regarded from various angles. Will the advantage gained from strengthening the relaxed ring outweigh the possible disadvantage of the double operation? Certainly the figures quoted above, indicating that 16 per cent of single hernia cases returned for operation on the other side, make this a factor of considerable moment. The majority of patients would undoubtedly prefer to have whatever surgery was necessary done at one time rather than return for a second operation. In itself the double operation should not make the risk of surgery any greater, but this fact alone is regarded by some as a definite contra-indication to the combined operation. Bunts is opposed to operating on a relaxed ring on the opposite side unless it is very definitely indicated, as it exposes the patient to the possibility of infection and the necessity of re-operation for recurrence. It is perfectly true that infection in a hernia wound greatly increases this possibility of recurrence, but we should certainly not adopt the attitude that slight prolongation of operation increases the risk of infection in clean hernia wounds. Hubbard (5) does not find that the double

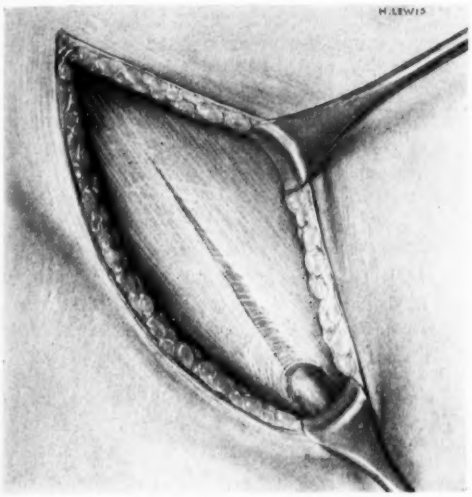

Fig. 1. Herniotomy incision through skin showing separation of fibers of external oblique aponeurosis and slight dilatation of external inguinal ring.

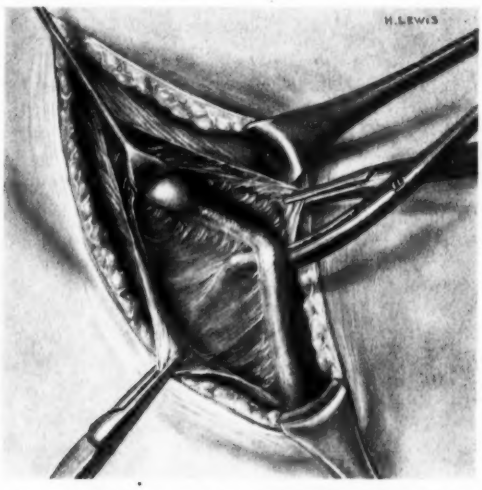

Fig. 2. Herniotomy incision completed. Internal oblique fibers retracted upward and cord elevated, showing small sac at internal ring.

operation increases the risk of wound infection, but does feel that it causes more frequent pulmonary complications.

In order to obtain, if possible, some light on this subject 100 consecutive double herniotomies were analyzed for postoperative complications. In these cases a number of operators over a period of several years, and different anæsthetists were involved. All patients had ether anæsthesia. In this group it was found that 5 wound infections occurred, 1 of these being only a slight stitch abscess. Surprisingly enough, all of the infections occurred on the first rather than the second side. Such a thing is difficult to explain, but nevertheless is the fact and certainly offers no evidence that the double operation increases the risk of infection on the second side. In this series also there occurred 4 postoperative pulmonary infections: 2 of these were of short duration and could hardly be called definite pneumonia; while of the other 2, 1 had before operation a chronic bronchitis. There were no deaths from pneumonia. In three of the cases the operation lasted for about 2 hours, while in the fourth the patient was under the anæsthetic for only 1 hour; all of the patients were 35 years or over.

To form a basis of comparison a similar number of single herniotomies was examined for postoperative complications and it was found that the same number of wound infections occurred, but only one postoperative pneumonia. We have, therefore, no difference in the incidence of wound infection in the two series, but in the double herniotomies four times the number of pulmonary complications. Of course these two series are really not large enough to permit of any definite conclusion, but can simply be regarded as suggestive.

Decker (2), in a compilation of postoperative complications of the respiratory tract from all types of cases occurring in different hospitals of the country, found that the morbidity percentage in 6 institutions ranged from 1.2 to 3.52 per cent, this highest figure corresponding very closely to the 4 per cent in this series of double herniotomies. It is difficult to explain the apparent increased incidence in the double operation. Various theories have been advanced, but none is entirely satisfactory. Possibly if more pains were taken in the pre-operative preparation of hernia patients the incidence would be reduced. These patients are ordinarily not ill

and we are not apt to regard the operation as a matter of such particular moment as to make so careful a pre-operative examination for mild upper respiratory infections. And finally in this general connection the patient's convalescence must be considered. A perfectly uncomplicated postoperative course in a case of double herniotomy need be no longer than that of a single herniotomy. In other words, the two wounds will heal just as quickly as one.

DISCUSSION

Admitting only the fact that there is some slightly greater risk of a pulmonary complication in individuals upon whom a double herniotomy has been performed, it certainly seems that the added advantage of obviating the very considerable risk of a second operation should more than outweigh this one fact. The question of infection can be dismissed and should, of course, be reduced in both types of cases by careful technique to an absolute zero. The incidence of infection in the cases reported is certainly far too high. In the 5 infections in the double hernia series 3 occurred in a group performed by one particular individual. It seems fairly well established by the presence of the preformed hernia sac, described above, that certainly in the inguinal region there has been advanced further confirmatory evidence of the theory that these herniæ all occur as a result of the presence of this persistent peritoneal funicular process. Further interesting evidence on this point might be gained by an examination of the internal ring during all laparotomies. However, it is rather doubtful that such a small opening and so small a sac could be recognized unless the internal ring could actually be seen, and this, of course, in many laparotomies is quite impossible. Such examinations have, of course, been made by various people in a more or less careful way, but no evidence of any particular value has been obtained. It will be extremely pertinent to follow some of the cases with simple tightening of the external ring in which no regard was paid to the possibility of the peritoneal sac.

Should none of these cases later on develop actual hernia, as they would be expected to do if ligation of the sac is so important a part of the general operative procedure, it would indicate that, in certain herniæ at least, sac ligation is not of such great importance. On the other hand, recurrence, or at least appearance of the hernia, would have a most important bearing on the whole subject.

CONCLUSIONS

1. In a series of cases in which the inguinal canal was opened on account of a relaxed ring and in which no clinical evidence of hernia was seen, in every instance a small persistent sac has been found.

2. Analysis of a group of cases shows that 16 per cent of individuals presenting hernia on one side eventually develop hernia on the opposite side.

3. It is felt that correlation of these facts lends further strong support to the preformed sac theory in regard to the etiology of all inguinal herniæ.

4. A study of 100 consecutive cases of both single and double herniotomies has shown that the double operation increases the incidence of postoperative pulmonary infections, but it does not increase the incidence of wound infection.

5. If any operative measures are used to repair the relaxed ring, a complete herniotomy should be performed.

BIBLIOGRAPHY

1. Coley, W. B. Traumatic and industrial hernia. Ann Surg., 1922, lxxv, 467–477.
2. Decker, H. R. Postoperative complications of the respiratory tract. Canad. M. Ass. J., 1922, xii, 541–548.
3. Erdmann, S. Inguinal hernia in the male; late results in 978 traced cases. Ann. Surg., 1923, lxxvii, 171–189.
4. Hammond, T. E. The etiology of indirect inguinal hernia. Lancet, London, 1923, i, 1206–1208.
5. Hubbard, J. C. Statistics of inguinal hernia. Boston M. & S. J., 1924, cxc, 536–537.
6. Keith, Sir Arthur. On the origin and nature of hernia. Brit. J. Surg., Bristol, 1923–24, xi, 455–475.
7. Russell, R. H. The saccular theory of hernia and the radical operation. Lancet, London, 1906, ii, 1197.
8. Idem. Inguinal herniæ, etc. Brit. J. Surg., London, 1921–22, ix, 502–508.
9. Seelig, M. G., and Chauke, K. S. A fundamental factor in the recurrence of inguinal hernia. Arch. Surg., 1923, vii, 553–572.
10. Taylor, A. S. The results of operations for inguinal hernia. Arch. Surg., 1920, i, 382–406.

A PRIMARY SPINDLE CELL SARCOMA OF MECKEL'S DIVERTICULUM

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MECKEL'S diverticulum is of rare occurrence, being said to appear in approximately 2.7 per cent of all individuals (3). Malignant tumors of the small intestine also are uncommon, probably composing not more than from 2½ to 3 per cent of all tumors of the intestines (1). It would be expected, therefore, that malignant tumors of Meckel's diverticulum would be exceedingly rare, in fact, in a review of the literature we find but few reported cases, among which we have been able to discover only seven reports of malignant tumors of Meckel's diverticulum, and only three of these were cases of undoubted sarcoma. To these we wish to add the report of a fourth case of sarcoma.

The patient, a woman, age 41 years, consulted Dr. Crile because of intestinal obstruction. The important points in the history as taken on the admission of the patient to Lakeside Hospital are as follows: Soon after the birth of her first child she began to have attacks of pain in the lower abdomen and back. The pains were periodic and grew worse and more frequent until the appendix, tubes, and ovaries were removed. After this operation she remained well for the next 5 years when, 8 months before her admission to the hospital, she again had attacks of cramp-like pain across the lower abdomen the pain radiating toward the epigastrium. At first these pains would appear after meals, but later they had no definite relationship to eating. Sometimes there were periods of several weeks during which the patient would be free from discomfort. During the 2 months before she entered the hospital the attacks had been more frequent and more severe. At times they had been accompanied by nausea but she had vomited only once or twice. Occasionally the abdomen had been distended and very tender. The patient had been constipated and had had frequency of micturition after the attacks but no sensation of burning and no hæmaturia. There had been some loss of weight and strength. The physical examination showed only the usual signs of partial intestinal obstruction, considerable tenderness and distention of the abdomen, and a small palpable tumor which was fixed in the right iliac area. Examination of the urine elicited no evidence of disease in the genito-urinary tract. A pre-operative diagnosis of incomplete intestinal obstruction was made.

Operation by Dr. Crile. When the peritoneum was opened considerable free fluid escaped. This at first was dark and slightly blood tinged and later consisted almost entirely of blood which had the appearance of having been in the abdomen for at least a week. A tumor as large as a pear was discovered which was adherent to the omentum and arose from a pedicle of the ileum at a point opposite its mesenteric attachment. The pedicle was cut away and the raw area closed over. The tumor was removed from the omentum by tying off and severing its attachment. No other pathological condition was found, so after ridding the peritoneal cavity of blood the abdomen was closed.

Pathological report. The specimen was submitted to the pathologists, Dr. Allen Graham and Dr. Fishbach, who made the following report: The specimen consists of a diverticulum from the small intestine and a tumor mass. The diverticulum is about 6 centimeters in length and 2.5 centimeters in diameter. It is quite firm and indurated at the tip and there are some adhesions. The tumor mass which was attached near the tip of the diverticulum was entirely within its lumen. The tissue is soft, friable, reddish gray, translucent and homogeneous on the cut surface. The inner lining of the diverticulum has, in many places, small grayish granular masses which are adherent to the wall and have the appearance of a papillomatous growth. Gross diagnosis: malignant tumor of the small intestine and diverticulum—probably Meckel's.

Histological description. The sections show a tumor composed in the main of rather large spindle cells although cells of many forms are mingled among these. Large irregular areas of hyaline connective tissue are scattered irregularly in the mass. In these connective tissue areas are many large blood vessels some of which have thick walls. There are a few blood sinuses with only an endothelial layer of cells forming the walls. The tumor cells vary in shape and size, but in the main are large spindle cells and show a large excess of chromatin with occasional mitotic figures. Scattered diffusely among these are polymorphonuclear cells, few in number (Fig. 1). Histological diagnosis: spindle cell sarcoma.

When all evidence of periosteal inflammation had subsided the patient was given a full course of deep X-ray therapy by Dr. Portmann at the Cleveland Clinic. The entire abdomen, back and liver areas were included in large fields, less than one half of the skin dose being given to each area on succeeding days. There was slight nausea following the treatment of the liver areas but otherwise the patient was not inconvenienced.

The patient was recently seen in February, 1925, more than a year since the X-ray treatment was given. At this time she was very well, had gained considerably in weight and showed no evidence of any tumor or metastases.

Fig. 1. Spindle celled sarcoma of Meckel's diverticulum. Photomicrograph of section. ×300.

It is obvious that the various pathological conditions associated with Meckel's diverticulum, such as inflammation, ulceration, perforation, intussusception, volvulus incarceration, and the presence of neoplasms are of considerable clinical importance. Unfortunately, however, they are not diagnosed except at operation or at autopsy. In the presence of any obscure abdominal condition, therefore, especially in one that simulates appendicitis, or in cases of obstruction, a surgeon should bear in mind the possibility that a Meckel's diverticulum is involved. Therefore, when at operation it is found that the appendix or other organs are not at fault, the last 3 feet of ileum where a Meckel's diverticulum occurs should be explored. It is stated by Mumford that this diverticulum is responsible for 6 per cent of all cases of obstruction and that inflammation has been present in 13 per cent of the reported cases of Meckel's diverticulum (7).

The structure of Meckel's diverticulum is similar to that of the appendix but perhaps contains more of the glandular structures. It would appear, therefore, that the tumors of the small intestine, which might occur in Meckel's diverticulum would be benign tumors of a cystic nature, fibromata, adenomata, myomata, lipomata, papillomata and angiomata. A benign carcinoid tumor has been described which has the appearance of pancreatic tissue or of an "accessory pancreas." The malignant tumors such as spindle cell sarcoma, lymphosarcoma, endothelioma, melanosarcoma, carcinoid tumors or malignant degeneration of a myoma are exceedingly rare.

PREVIOUSLY REPORTED CASES

As stated above we have been able to find only 7 previously reported cases of malignant tumors of Meckel's diverticulum of which only three were sarcomata.

The first mention of such a case which we have discovered is a statement by Kaufmann (6) that the Basle collection contained a specimen of a spindle cell sarcoma of a Meckel's diverticulum.

In the same year, 1911, Tschiknawerow (9) reported a sarcoma of Meckel's diverticulum in a woman 62 years of age, discovered at autopsy. He also states that the only like case he had been able to discover in the literature was that mentioned by Kaufmann.

In 1913 Haessner (4) again reviewed the literature adding to the two cases cited above one reported by Fried, in 1902, as a myxosarcoma or fibrosarcoma arising from a point opposite the mesenteric attachment of a Meckel's diverticulum. Haessner adds a case of his own which he describes as a "rapidly disintegrating, apparently malignant tumor in the region of the ileum adherent to a Meckel's diverticulum." While it is stated that it is doubtful whether or not the primary site of this tumor was in the intestines or the diverticulum, the author believes that it was the latter.

Symmers (8) studied a case of malignant leiomyoma springing from the base of a Meckel's diverticulum. In his review of this subject he stated that he had been able to find only one similar case in the literature, that reported by Fried.

In 1919 Black (2) reported a case of a potentially malignant growth in a Meckel's diverticulum apparently papillomatous, which arose from the tip of what he considered a congenital diverticulum of the sigmoid.

Braxton-Hicks and Kadinsky (5) (1922) have reported a case of "carcinoid tumor" of a Meckel's diverticulum, in which the submucosa showed a mass of glandular tissue somewhat resembling shrunken "pancreatic tissue" which did not penetrate into the underlying fibromuscular structures.

REFERENCES

1. Adami, J. G. The Principles of Pathology. 1908, ii, 442.
2. Black, W. T. Congenital diverticula of the intestines. Surg., Gynec. & Obst., 1919, xxviii, 473–477.
3. Ewing, J. Neoplastic Diseases. 2d ed. 1922, pp. 661–662.
4. Haessner, H. Zur Pathologie des Meckelschen Divertikels. Frankf. Ztschr. f. Path., 1913, xiv, 501–506.
5. Hicks, J. A. B., and Kadinsky, S. "Carcinoid tumor" of Meckel's diverticulum. Lancet, 1922, ii, 70.
6. Kaufmann, E. Lehrbuch der speziellen pathologischen Anatomie. 6th ed. Berlin: 1911, p. 465.
7. Mumford, J. G. The Practice of Surgery. 2d ed. 1914, pp. 57–58.
8. Symmers, Douglas. The association of malignant myomata with Meckel's diverticulum. Ann. Surg., 1919, lxx, 183–187.
9. Tschiknawerow, L. Zur Kenntnis der pathologischen Gewebsbildungen im Meckel'schen Divertikel. Berl. klin. Wchnschr., 1911, ii, 1676–1679.

RETROPERITONEAL CYSTS

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RETROPERITONEAL cysts are infrequent surgical occurrences. Those tumors, posterior to the peritoneum, whether they are cystic or solid tumors of the liver, pancreas, kidneys, adrenals, mesentery, lymphnodes, lymphatics, or omentum, are of sufficient rarity to make the report of cases of more than incidental interest.

From an embryologico-anatomic viewpoint they are of considerable significance. As a rule, they are met with by surgeons in patients who come complaining of either a localized or general abdominal enlargement. The case presented and the comments following deal with a cystic tumor of the retroperitoneal space, not attached to any solid or hollow viscus, but supposedly originating in vestigial remains of fetal structures.

REPORT OF CASE

The patient is a boy of 3 years of age. He was admitted to the Second Surgical Division of the Roosevelt Hospital, October 22, 1923, complaining of swelling of the abdomen. The family history is irrelevant. About one year ago patient had swollen glands in neck. These lasted 3 weeks but did not break down. At the age of 4 months, patient had whooping cough, measles and chicken pox, one following the other.

Present illness began 9 days ago when patient's mother noticed that his clothes began to fit him very tightly around the abdomen, and that there was a definite increase in the size and prominence of his abdomen. Coincident with this was a noted loss of appetite, but at no time did patient complain of any pain. He was not confined to bed, but appeared well and played about the house all day. Sleep was undisturbed. The bowels were regular, moving once or twice a day. Father of patient thought that upon one occasion the stools had a reddish brown appearance. Father states that patient was jaundiced for first 7 days of present illness. He presents icteric tint to face and scleræ of eyes. The abdomen became progressively larger.

Physical examination. Patient appears to be a well nourished but decidedly pale and sick looking child, with anxious face and bulging abdomen. Tonsillar and posterior cervical and inguinal lymph nodes are enlarged but not tender. The heart is normal throughout. The lungs present a few moist râles heard over the posterior chest. Rectal examination is negative. The abdomen is markedly protuberant, more so on the right side than on the left, and does not move with respiration. No definite mass or peristaltic waves are seen. The umbilicus bulges slightly. The abdominal wall seems tense throughout, but there is added rigidity on the right side in both upper and lower quadrants. The circumference of the abdomen at the umbilicus, on admission was 55 centimeters; on October 31, the day prior to operation, 57 centimeters. The whole right side gives one the impression of a markedly distended mass as if it might be a distended ascending colon or a cystic tumor. The spleen, liver edge, and kidneys are not felt. No shifting dullness or fluid wave could be heard. Nothing could be heard on auscultation. The urine is negative. X-ray examination after colon enema show that the barium passes back to the hepatic flexure at which point it abruptly terminates. The plates suggest a lesion

Fig. 1. Huge retroperitoneal cyst showing two daughter cysts. Intestines pushed upward and to the left.

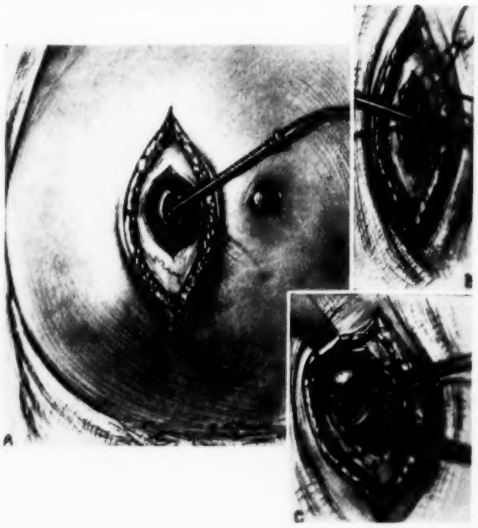

Fig. 2. *a*, Incision through abdominal wall, showing the cyst wall, bulging into wound, and trocar with suction apparatus inserted.

b, Suture of posterior parietal peritoneum and cyst wall to edges of wound and anterior peritoneum. *c*, Retraction of the abdominal opening showing daughter cyst.

at this point. On admission, hæmoglobin was 45 per cent; white blood cells 8,000; polymorphonuclears, 67 per cent. The stools were yellow in color with much fat, no bile, no blood, no ova or parasites. Von Pirquet test negative.

Note made on October 30, 2 days prior to operation. Patient's temperature has gone up to 104.6 degrees, pulse 132, respiration slightly increased, white blood cells, 10,000 and polymorphonuclears 80 per cent. He looks very sick, pale, apathetic, refuses food, and complains of pain in abdomen. The abdomen seems more tense. Definite tenderness is elicited in the right upper and right lower quadrants as well as in the epigastrium. The lungs are clear. Patient complains of great thirst. Colon irrigations and turpentine stupes relieved him of considerable flatus but very little fæcal matter was passed. It was thought that operation on abdomen was imperative.

Pre-operative diagnosis: tuberculous peritonitis.

Operation. On November 1, 1923, under light drop anæsthesia, an incision, approximately 4 inches long, was made to the right of the midline, center of incision being at level of umbilicus. The peritoneum was opened. No fluid escaped. No intestines were seen, but a dark, bluish red membrane, containing numerous blood vessels, presented into the wound. On retracting the wound upward, the cæcum, appendix, and transverse colon were found pushed high up under the liver and spread out over the dome of a great cyst wall. The mass or cyst had apparently pushed the posterior peritoneum forward. Coils of small intestines lay to the left of the bulging cystic tumor. Stomach, liver, and gall bladder appeared normal on palpation. The right kidney could not be felt as the distended cyst interfered with the palpation of this organ. The cyst extended downward to about the level of the false pelvis. It was easily seen that it was impracticable, on account of the patient's condition, to remove the entire cyst, so it was decided to evacuate the cyst and establish drainage. Patient's condition did not warrant much manipulation. A trocar puncture was made and suction was applied and about 850 cubic centimeters of dark red fluid suctioned off. The trocar puncture wound into the cyst wall was enlarged to the extent of about 2.5 inches. A small piece of the cyst wall was removed for microscopic study. The opening in the cyst was brought up and carefully sutured to the peritoneum. Two fingers were inserted into the cyst cavity and two smaller cysts were opened into with the index finger. They lay, one to the left and one to the right of the spinal column, high up in the mother cyst. About 150 to 175 centimeters were evacuated from each of these smaller cysts. After removal of all fluid, the right kidney could be palpated as normal. The left kidney was palpated with some difficulty but was thought to be normal. Wide gauze packing was inserted into the smaller cysts and also into the large cyst cavity. A small strip of gauze was placed in the lower angle of the abdominal wound. The wound and the abdominal

Fig. 3. Sagittal section with gauze packing in mother cyst and two daughter cysts. Inserted gauze packing protruding from wound.

Fig. 4. Photograph of patient 2 months after operation.

wall were closed with continuous plain catgut to the peritoneum, interrupted catgut to the fascia, silkworm gut and silk to the subcutaneous tissue and skin. Patient's pulse which was 120 at the beginning of operation was 150 at the close. His condition seemed precarious and therefore but little ether was given.

Examination of cyst fluid. Appearance, bloody; specific gravity, 1030; albumin, present; serum, 1023. A smear shows red cells predominate, polymorphonuclears 74 per cent; mononuclears, 22 per cent; transitionals, 5 per cent; many bacilli present; also, a few short chained micrococci. Culture of cyst fluid shows presence of bacillus coli and bacillus pyocyaneus.

Postoperative course. Convalescence was stormy. During the first 8 hours there was very little reaction; temperature 102 degrees, respiration 24, pulse 140. Patient retained fluids by mouth and rectum. The first day after operation the temperature rose to 105.6 degrees, and patient became delirious. Pulse was 160 and weak. Following this sharp reaction, the temperature gradually fell, the pulse became slower and from then on patient continued to improve.

On the sixteenth postoperative day, all drains were removed. Following removal of these drains, some vile smelling pus was expressed from the wound. The wound was still discharging and in good condition.

December 14, 1923, patient was sent home, pronounced cured, having been in the hospital over a period of 53 days.

Recall note, January 4, 1924: Patient returned to hospital with wound entirely healed. There was no discharge whatsoever. He has gained weight, the bowels are regular and he is in excellent health.

January 18, 1924. Patient returned to hospital again. No complaints to make. He eats everything and sleeps well, and is apparently in the best of health. The wound is firm, and there is no evidence of herniation. He was told to return in 6 months for a second official recall.

July 20, 1924, patient has gained in weight, is in excellent health.

December 1, 1924, in every respect patient is in normal health. He is still gaining in weight.

There are but few cases like the one described above found in the literature of this country. For the most part, retroperitoneal cysts have been reported in foreign literature.

Koenig (8) gives due credit to Roth as the first to point out the origin of these interesting cysts as having sprung from the wolffian body or the muellerian ducts. Lobestrum (10) was the first to describe in any detail, tumors of the retroperitoneal area.

In the literature carefully reviewed, the case most similar to my own (as reported above) is one reported by Simpson (14). His case was a girl of 6 with a symmetrical enlargement of the abdomen since the age of

two, increasing noticeably. The mass filled the whole lower abdomen and extended upward to a point halfway between the umbilicus and the ensiform. The palpating hand sensed deep seated fluid under tension. The preoperative diagnosis was large ovarian cyst. Operation disclosed a large retroperitoneal cyst containing 45 ounces of thick brown fluid. The cyst was one-half inch thick. The entire cyst wall was removed in two stages, it being "very adherent posteriorly to the aorta, vena cava, iliac vessels, ureters, and vertebral bodies." Recovery was complete. Excellent cure.

Ashhurst and McGuire's (1) case was an adult, "a woman of 26 years with a history of sharp pains in right side of abdomen for 3 years, brought on by lifting a heavy weight, taking a quick step upstairs or turning suddenly in bed. A mass of the size of a lemon was palpated in the region of the cæcum." Pre-operative diagnosis was chronic salpingitis and retroversion of the uterus. At operation a fetal head sized retroperitoneal mass was found in the right fossa, extending from the brim of the true pelvis to just below the right kidney. The cyst contained clear fluid like "spring water." The cyst wall was enucleated. Immediate and permanent cure was effected.

Maury (11) reported an unusually large cystic tumor in a woman of 28 years, extending from the pubis to the costal margin with no demonstrable pedicle. Yet, while dissecting free the lower pole, a tubular structure was found which he traced down under the sigmoid and out into the broad ligament, there ending, half-way between the uterus and the pelvic wall. He believed that this terminated in the parovarium.

LaPointe (9) publishes a case of a woman 43 years old with a double retroperitoneal cyst, one voluminous cyst in the left flank and the other a smaller one in the right iliac fossa, both situated in the retroperitoneal space. Complete removal of both cysts was accomplished. These cysts were lined with cuboidal epithelium with slightly staining nuclei and protoplasm deeply stained with eosin. The epithelium closely resembled that of the glomerulus or canals of the wolffian body. There are numerous other interesting cases reported, but the ones quoted above seem sufficient to show the typical cysts of the space posterior to the peritoneum.

PATHOGENESIS

The origin of the cysts forms the most interesting phase of the entire study, notwithstanding the fact that the diagnosis is both puzzling and difficult. The treatment is simple and the prognosis easy. There is varied speculation as to exactly which structure posterior to the peritoneum they arise from, yet, it is agreed, almost universally, that they spring from some portion of (a) the developing urogenital tract or from some variation in the (b) developing retroperitoneal lymphatic system. It is from these two, (a) and (b), that most of the large and interesting cysts arise. However, it is worth noting that some have grown from cell inclusions; (c), the dermoid or teratomatous cysts are composed of a thick walled cyst containing teeth and hair and grumous material; (d) the blood cysts, as the name implies are huge cystic collections of extravasated blood in the retroperitoneal space, due to injury of blood vessels of the retroperitoneal space; (e) the parasitic cysts reach the area either by going directly through the intestinal wall into the retroperitoneal space or by the blood stream; (f) the mesenteric cysts lie between the leaves of the mesentery of any part of the bowel, more commonly between the fold of mesentery of the ascending and descending colons. Dowd's (3) splendid contribution to the subject of mesenteric cysts should always be looked into when one is interested in this particular type of cyst.

In the developing urogenital tract, which is exceedingly complicated, with great numbers of tubules and other fetal structures which undergo cystic degeneration and then disappear, it seems ample opportunity is sometimes afforded for one of the tubules not to disappear by cystic degeneration but to develop gradually into a retroperitoneal cyst. In view of this, it may be of interest to state briefly the development of the genito-urinary system for surely these cysts, for the most part, come from persistent developing fetal remains of the pronephros, the mesonephros,

and the metanephros. Particularly is it believed that they originate from the wolffian duct which is the primary excretory duct of the pronephros and the mesonephros or from the muellerian duct which is formed from invagination of the colæmic mesothelium into the superior aspect of the urogenital fold, at about the level of the third segment.

Cysts, which are conclusively proved to arise from the wolffian body, show primitive glomeruli and kidney tubules in some place or places in the cyst wall. Hinman, Gibson, and Kutzman (7) state:

"Literature, however, abounds with reports of cysts which present none of these structures but are considered as being of wolffian origin—either mere supposition or reason by process of elimination." A greater number of retroperitoneal cysts occur in the female than in the male. It is supposed that a greater amount of wolffian body remnants exist in the female than in the male.

A. Pronephros. The pronephros with the pronephritic duct is the first of the urinary organs to appear. It is transitory—seen first in the 1.73 millimeter embryo and disappears by the time the embryo has developed into the 4.9 millimeter stage. The pronephros and the mesonephros have a segmental arrangement. The mesonephros segmentation begins at the vertex end and develops caudally until complete; likewise, pronephric rudiments begin in the head region, the first tubules being so short lived that they are undergoing degeneration when the caudal ones appear. Pronephric tubules do not exist beyond the twelfth primitive segment. In the growing embryo the twelve segments eventually correspond with the bursa omentalis and it is for this reason that pronephric remnants are likely to be the origin of some retroperitoneal cysts.

B. Mesonephros. The mesonephros which constitutes the second set of urinary organs appears immediately following the pronephros. From the mesonephros are developed the genital glands and all tubular structures in the region of the broad ligament in the female, arising particularly from the parogenitalis tubules (the lower group of tubules from the seventieth to the eighty-third) and it seems likely that retroperitoneal cysts in the pelvis must have their beginning in these early mesonephric structures which have not completely degenerated. Felix (4) states that 57 out of 83 mesonephric tubules degenerate and supposedly disappear entirely. They all lie posterior to the peritoneum and some, no doubt, fail to degenerate and proceed on to the development of cysts.

C. Metanephros. The metanephros or kidneys is the third set of urinary organs to develop. It is divided into the excretory and the efferent systems. The excretory duct arises from the nephrogenic cord, and this duct in conjunction with the ureteric bud, develops various sets of tubules. Finally twelve orders of tubules are formed, each with its own excretory cap, the kidney being formed from a coalescing of the branches of the ureteric tree and islands of excretory tissue. Bowman's capsules and uriniferous tubules are derived from the excretory caps. It is in the union between terminal collecting tubules and the uriniferous tubules, which is a complicated process, that variations and disturbances of development may give rise to marked anomalies (6). The lymphatic system as Sabin (13) has shown is in part derived from the veins or, in other words, lymphatic vessels are modified veins. In the early stages, there are series of isolated lymph sacs which, beyond question, are derived from veins and later on, the thoracic duct connects all these sacs—one with the other. There are four of these sacs: (1) The jugular sac lined with endothelium is filled with blood and lies close to the jugular vein, (2) the retroperitoneal sac in the abdomen opposite the lower thoracic and upper lumbar vertebræ; (3 and 4) pelvic sacs, lying posteriorly on either side of the pelvis. In the connecting up of the lymph sacs or later when the lymphatic capillaries and lymph nodes are being formed, any error in development at this stage could easily account for the presence of a chyle cyst in this area.

Baetzer (2) has demonstrated, in the embryo pig, a direct communication between the lymph sac and the inferior vena cava. However, these communications were only transitory. Sylvester (15) has shown that in

South American monkeys a permanent communication exists between the lymphatic and venous systems at the level of the renal veins. In this connection he says: "Whenever the mesenteric or inguinal lymphatic nodes of a New World species were injected the injection mass never passed from the lumbar or intestinal lymphatic trunks into the thoracic duct or into the anterior regions of the body, but passed directly into the postcava in the region of the renal veins. A more detailed examination of the vessels in this region of the body revealed the fact that the lymphatics of the digestive organs and of the posterior extremities invariably enter the venous system at the level of the renal veins."

In 1914 Halsted (5) removed from the abdomen of a woman about 40 years of age a large congenital lymph cyst in the right upper quadrant. The cyst was attached in two places to the interior vena cava. In separating the cyst from the large vein in both instances, blood gushed out through slits in the vena cava wall, "the edges of the slits were smooth, the linear defect being clearly not due to a tear or a cut." Halsted's explanation of the presence of blood so often (as in my case) noted in these cysts is that a lymphaticovenous fistula exists and that blood appearing in the third or fourth tapping as is sometimes met with, is due to a negative pressure within the cyst cavity following the tapping and this negative pressure opens up again these embryonic defective slits in the vena cava, allowing blood to seep in. He felt that the explanation offered so many times for blood in these cysts, to wit, trauma, was insufficient.

PATHOLOGY

Cysts may be single or multiple. They are classified as (a) a single unilocular cyst, (b) a single cyst with smaller daughter cysts rising from its wall or cysts in the larger cyst cavity, (c) a mass of cysts of approximately the same size without any connections between them and not one of which can be called a mother cyst, (d) multiple cyst adenomata. The wall is composed of fibrous tissue and the lining membrane may be loose or close connective tissue without epithelium, as seems to be usual in the true lymph or chylous cysts. Hygromata of the neck and the primitive lymphatic sacs are not lined with epithelium while in those cysts of urogenital remnant origin, the lining membrane is made up of epithelial cells of the flat, cuboidal, ciliated or columnar type. The lining epithelium of the transverse tubules of the wolffian bodies is more highly developed epithelially than the lining of the duct; hence, it is easily imagined that the simple cysts in all probability arise from the ducts while the adenomatous cysts arise from the tubules. The contents of the cysts are (1) lymph, (2) blood, (3) jelly-like pseudo-mucin or colloid, (4) hair, teeth and grumous material as in the dermoid, (5) parasitic elements, (6) combinations of one or more of the above.

SYMPTOMATOLOGY

The most frequent symptom is either a localized or general increase in the size of the abdomen or occasionally, localized pain or pain referable to pressure on the dorsal nerves. When these tumors are situated in the pelvis and are of a large size, they produce symptoms which are common to any other large tumor, likely situated. Infrequently, there are œdema and varicosities of the lower extremities. Bladder symptoms may be annoying, due to pressure on the viscus. As the tumor gradually enlarges, upward disturbances or respiration are complained of—they may grow to such an extent as to cause pressure on the bile duct resulting in jaundice. There is loss of weight and cachexia, especially if the cyst be of a malignant nature. More frequent than otherwise, the symptoms are vague and the signs indefinite.

DIAGNOSIS

A correct pre-operative diagnosis of a retroperitoneal cyst is difficult to make, especially if the tumor is found in an adult; with a child, one suspects a cyst more often in this location than in an older person. They are repeatedly diagnosed as (1) ovarian cysts, (2) hydronephrosis, (3) tuberculous peritonitis, (4) tumors of the kidney as sarcoma or polycystic kidney. The abdominal swelling may be symmetrical or asymmetrical. Especially in

those cysts lying in the loin is a pyelogram helpful. When small, the cyst is movable but as its wall gradually becomes adherent to the under surface of the posterior peritoneum, it is not movable—not even does it move with respiration. The majority are diagnosed in the course of an exploratory cœliotomy, for vague abdominal symptoms with enlargement or by the pathologist. To prove their origin, it is necessary to enucleate completely the stork appendix with the cyst attachments and to have microscopic studies made, not only of the cyst wall, its lining and its entire structure, but also of the structure from which the cyst arises. It is well to note carefully and analyze chemically the contents, for often it is from the contents alone that a correct diagnosis can be made.

TREATMENT

The treatment of retroperitoneal cysts is simple. It entails no complicated procedures. Usually, enucleation or marsupialization, either in one or two stages (seldom more) is all that is necessary. Those of developmental origin are easily enucleated. An incision should be used which gains easy and comfortable access to the cyst. The approach through the loin gives good exposure to many. Infected dermoids or parasitic cysts give the most trouble in treating as drainage must be established and continued for some weeks. An enucleation in one stage is the procedure of choice. However, in children, when the cyst is large and the condition of the patient none too good, it is wise to empty and remove cyst wall in two stages or to marsupialize. Primrose (12) has presented a method to marsupialize with the least possible or no soiling by suturing an opening in the posterior parietal peritoneum to an opening in the anterior parietal peritoneum. The cyst wall proper is then attacked and is dealt with entirely outside the peritoneal cavity. The cyst lies at the bottom of the wound and can easily be opened and drained; especially is this method applicable to infected cysts or to those which rise retroperitoneally from the pancreas.

SUMMARY

1. These cysts are rare and each case should be reported, special attention being paid to the origin.

2. Detailed macroscopic and microscopic descriptions of the pedicles or of the tissue in close proximity to its origin should be noted, as well as chemical and microscopical study of the contents.

3. The most interesting of these cysts originate in vestigial remains of the developing urogenital tract or in the lymphatic systems. Those lined with epithelium come from the former and those without a lining membrane, from the latter.

4. The diagnosis is difficult and symptomatology of but scant help.

5. Treatment is simple: enucleation in one or two stages, according to size of tumor and condition of patient, or marsupialization.

6. Prognosis is good. There is seldom a recurrence.

BIBLIOGRAPHY

1. Ashhurst, A. P. C., and McGuire. J. Am. M. Ass., 1920, lxxv, 1494.
2. Baetzer. Am. J. Anat., 1908, viii.
3. Dowd. Ann. Surg., 1922, xxxii.
4. Felix, Kiebal and Mall. Textbook of Embryology, ii.
5. Halsted. Tr. Am. Surg. Ass., 1919, xxxvii, 37.
6. Handfield-Jones. Brit. J. Surg., 1924, xii.
7. Hinman, Gibson and Kutzman. Ann. Surg., lxxix, 765.
8. Koenig. Arch. f. path. Anat., 1881, lxxxvi, 371.
9. Lapointe. Bull et mém. Soc. chir., xlviii, 319.
10. Lobestrum. Lehrb. d. Path. Anat., Stuttgart: 1835, i, 111.
11. Maury. Surg., Gynec. & Obst., 1918, xxvi, 663.
12. Primrose. Surg., Gynec. & Obst., 1922, xxxiv, 431–436.
13. Sabin, Kiebel and Mall. vol. ii.
14. Simpson. South. M. J., 1923, xvi, 121–124.
15. Sylvester. Am. J. Anat., 1912, xii.

OSTEITIS FIBROSA AND THE HYPEROSTOTIC FORM OF BONE SYPHILIS[1]

A Comparative Anatomical and Roentgenological Study

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CONSIDERABLE difficulty and confusion still exists in the gross anatomical and roentgenological differentiation between the hyperostotic form of bone syphilis and osteitis fibrosa. Briefly, it can be stated that all congenital and acquired syphilitic changes of the skeletal system are the result of two fundamental processes going on simultaneously: first, *the destruction of bone substance by syphilitic granulation tissue*, and second, *the new formation of bone*. Syphilitic granulation tissue is laid down in a simple inflammatory non-specific form or as circumscribed gummata. It is thus possible to distinguish between simple and gummatous periosteitis, as well as between simple and gummatous osteitis and osteomyelitis. However, it is characteristic of syphilis frequently to find these forms in combination. Moreover, there are often added the complicating infiltrative and ulcerative processes in the overlying soft parts, occurring especially in the superficial bone lesions. There is, as well, the secondary reactive and reparative formation of new bone around gummata and in the healing of bone defects. It is in the varying combination of these factors of destruction and repair that the great variations are to be noted in the anatomical and roentgenological pictures in bone and joint syphilis.

The primary purpose of the investigation which I have undertaken is an effort to establish the differential diagnosis of the hyperostotic form of bone syphilis from osteitis fibrosa. A further effort will be made to establish a basis for the roentgenological recognition of these two diseases upon the anatomical and pathological characteristics of the affected bones. As will be seen, the subject of bone syphilis is intimately joined with that of osteitis fibrosa. This study will be largely concerned with the anatomical and roentgenological differentiation of these two diseases.

Hahn and Deycke (11) in 1907 were the first to systematize clearly the manifold roentgen pictures of delayed congenital and acquired syphilis, and to describe the roentgen diagnostic characteristics of the individual forms. Anatomically and roentgenologically, the purely osteoplastic bone lesions form a particular and characteristic group. They occur either as circumscribed tophi, or as diffuse hyperostoses of the long bones. The latter is the clinically important form. It is less common than the gummatous form and may occur both in delayed congenital and in acquired syphilis. Its sites of predilection are the tibia and the bones of the forearm, as generally in bone lues, though other long bones may also be affected. In contrast to the gummatous form, the soft parts are not involved in the diffuse hyperostotic type of bone syphilis.

The first particular clinical and roentgenological study of the diffuse hyperostotic form of syphilis was made by Axhausen (1) in 1913. The change in the external appearance of the bones is remarkable. They become plump, irregularly thickened, and deformed. At times, even monstrosities result. Sometimes they are sclerotic and heavy, and in other cases, lighter and more porotic. The outer surface of these bones is usually rough, often being covered with fine and coarser, jagged, stalactite-like processes. Adjacent bones, such as tibia and fibula, or radius and ulna, may be synostotically joined. When sawed through in the long axis, the cross section of the bone shows a fundamental change in the internal architecture. The normal boundary line between the compacta and marrow cavity is gone. The original compacta has disappeared, and has been replaced by dense, sclerotic, even ivory-like, bone, or by a finely porous bony structure resembling pumice stone. The former marrow cavity is filled by continuity by a similar bony struc-

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ture. This osteoplastic inflammation begins in the bone cortex, as an osteitis or, in a narrower sense, it originates in the marrow cavity as an osteomyelitis (compare Hahn and Deycke, 11). Practically in all cases, the periosteum also is involved in the process.

As pointed out by Axhausen (1), necroses of the original bone, and also of the newly formed bone, play an essential rôle in the often excessive formation of new bone. As is the case with all bone necroses, they exert a powerful stimulus upon the osteogenetic tissues, i.e., the periosteum, endosteum, and connective tissue. The necrotic areas become surrounded and infiltrated by proliferating bone building tissue. In this manner the newly formed bone structure finally completely replaces the preformed dead bone. A rarefying osteitis may occur in an originally sclerotic area, leading in such a case to a secondary osteoporosis. On the other hand, the originally looser, newly formed, spongy bone in healing may become sclerotic.

Corresponding to these anatomical changes, the normal line of demarcation between the corticalis and the marrow cavity can no longer be seen on the roentgen picture. Instead, the more or less irregularly thickened bone casts a diffuse, dense, broad, or a lighter, spongy shadow. It is often mottled by irregularly outlined, denser dark spots. Enclosed in this diffuse shadow, one can often recognize rests of the original corticalis band shadow. These represent the remains of the original compacta, which have not as yet been rebuilt. The periosteum is so intimately involved in the process, that, as Hahn and Deycke emphasize, it can be recognized only with difficulty here and there. These authors also state that the marked widening of the bone is not essentially due to periosteal bone deposition, but that for the most part, it is the result of purely osteitic processes. Furthermore, they have described a peculiar and characteristic structure of the thickened bone mass. Not uncommonly, the roentgen picture shows dark and light striping, directed lengthwise, parallel to the corticalis, giving the impression of a regular arrangement. They believe that these striped areas are due to exudate in the haversian canals, and that they are distributed in a very characteristic manner according to the degree of the general bone involvement. This roentgenological structure as described by Hahn and Deycke has been shown to be correct (compare our findings). However, it has nothing to do with the haversian canals or haversian spaces, i.e., haversian canals pathologically widened by syphilitic granulation tissue; nor with any preformed spaces. On the contrary, this peculiar shadow network corresponds to the axially directed meshes of the completely new-formed spongiosa, which has replaced the original bone. It contains longitudinally directed, somewhat irregular, small hollow spaces, but no haversian canals. These have disappeared with the destruction of the old compacta.

Osteitis and osteomyelitis simplex diffusa osteoplastica give a characteristic diagnostic roentgen picture, according to Hahn and Deycke. Pictures of this kind (compare Plate XI, Figs. 14, 15, 16) are seen in no other disease except lues. Axhausen (1) thinks that it is not difficult to recognize them as syphilitic, but that this can be done only when the periosteal surface shows the characteristic roughenings and serrations. If, on the other hand, the periosteal surface is smooth, these roentgen pictures can hardly be distinguished from those of osteitis fibrosa. Three such cases, involving the radius, humerus, and clavicles, with corresponding roentgenograms, are reported by Axhausen. In Case 2, of syphilitic osteoplastic osteitis and osteomyelitis humeri, in an 18 year old girl, the roentgen picture shows, exclusive of an almost unchanged lowermost portion, a uniform, diffuse bone shadow, surrounded by a thin corticalis. This picture (and particularly such pictures of the tibia) according to Axhausen, could hardly be distinguished from osteitis fibrosa. A differential diagnosis of the two diseases on the basis of such roentgenograms, would be impossible.

For practical differential diagnosis, we have additional diagnostic aids at our disposal, such as, the anamnesis, clinical findings, the Wassermann reaction, the therapeutic test and the surgical removal of a specimen for histological study. However, the anamnesis and clinical observations may lead us astray,

and failure to improve under antiluetic treatment does not, of course, rule out syphilis. A case of osteitis fibrosa may have a coincident positive Wassermann, or despite lues, a negative Wassermann may be present. However, since the histological pictures of the two diseases are radically different, the surgical removal of a specimen for microscopic study, taken from a proper place, would make the diagnosis. Nevertheless, this is a rather heroic measure.

In all events, there seem to be at least gross morphological similarities between the clinical pictures of hyperostotic bone lues and osteitis fibrosa (von Recklinghausen, 23). The latter is identical with, or includes osteitis deformans of Paget (18, 19), osteodystrophia deformans of Mikulicz (17) or E. Rehn (25), and osteodystrophia fibrosa of Stenholm (30). The false interpretation of purely morphological resemblances has led to considerable confusion in this field. Hutchinson (12) already had spoken of an osteitis deformans in cases of syphilis. In 1885 Silcock (27) pointed out the illusory similarity of the bone changes in delayed congenital lues, particularly in the tibia, to those of osteitis deformans (Paget). Werther (31), in 1891, reported a case of a 16 year old boy, with deforming osteitis of both tibiæ and the right femur, on a hereditary syphilitic basis. Lannelongue (15), in the Académie de Médicine in Paris (1903), attempted to prove that luetic bone changes which occurred in childhood and adolescence were analagous and even identical with those seen in Paget's disease in middle and advanced age. According to him, osteitis deformans (in the sense of Paget) is a *syphilis osseuse héréditaire tardive*, which has taken on the special characteristics of the age at which the individual is affected. Thus, he considers Morbus Paget as the *type des adultes et des vieillards*, in contradistinction to the pueri-adolescent type, *chez les enfants et les adolescents*. Fréchon (9), Ménétrier and Gauckler (16), and others, among these Fournier (6, 7), support Lannelongue's contention. Fournier considers Paget's disease as a parasyphilitic affection. The influence of this theory is still seen, though somewhat attenuated, in the work of Skillern (28) in 1913, who, on the basis of a positive Wassermann in a single unproven case, considers that at least some cases of osteitis fibrosa (osteomyelitis fibrosa solida, Bloodgood, 3) are identical with delayed congenital bone syphilis. As we have already indicated, this conception of osteitis deformans is based mainly upon the similarity of the external, gross morphological changes in the affected bones and extremities.

In Paget's disease the bones are plump, irregularly thickened, and deformed. Because of their rebuilding and complete change in architecture, the bones may take on very bizarre appearance. As in cases of lues, the tibia is frequently affected in osteitis fibrosa, at times even being the only bone involved. The elongation and accompanying bowing of the long bones, particularly of the tibia, observed in syphilis, occur likewise in osteitis fibrosa. Fournier (6), as early as 1886, considered the sabre-tibia (*en lâme de sabre*) pathognomonic for delayed congenital lues. Lannelongue (15) speaks of a tibia *en fourreau de sabre*, a sabre scabbard tibia. The tibia is bent on the straight fibula, the latter corresponding to the string of a bow. The tibia bows as a result of its elongating without corresponding lengthening of the fibula. However, elongation may have occurred even when a perfectly straight tibia is seen (compare, for example, with Benazet, 2, Fig. 18, obs. 24, in a girl 5 years old, and Fig. 35, obs. 27, in a girl of 6 years). Other bones may become elongated and deformed, such as the ulna (Krayn, 14, p. 11) or the radius (Stadler, 29, and our Case 8, see below), in these cases with bilateral sabre-tibia also. The pathognomonic significance of the sabre blade, or sabre scabbard tibia, for congenital lues has been overthrown since Gangolphe (comp. Benazet, 2, p. 109) who cites other authors, and Fritsch (10) in 1910 have reported the occurrence of tibia *en lâme de sabre*, in cases of syphilis in adult life, i.e., after the age of growth.

The gross resemblance between the tibia *en lâme de sabre* of lues and the sabre-tibia of osteitis deformans cannot be denied. But the underlying histological process, resulting in the rebuilding and the new form of the bone in osteitis deformans, is entirely different from that in diffuse syphilitic osteomyelitis. There-

fore, it seems inexplicable that Skillern (28) should feel disinclined to excise a specimen for histological study, on the ground that, "the microscope would be no better arbiter here than the methods described, for when the skiagram shows areas of bone absorption and of bone production, we can picture in the microscope of our minds the busy osteoclasts demolishing and osteoblasts constructing respectively."

In syphilitic osteomyelitis simplex diffusa osteoplastica, the marrow in the interstices of the spongiosa and the haversian canals is converted into syphilitic granulation tissue. The original bone is resorbed by giant cells (osteoclasts), while osteoblasts build new, reticulated (*geflechtartig*) bone which fills in the widened spaces. This new bone again may be destroyed and replaced by new reticulated bone. Portions of the bone may become necrotic and thus act as a special stimulus to the formation of new bone (compare above). In this manner the preformed bone structure disappears, and sclerotic, or more porotic-hyperostotic long bones are formed.

In Paget's disease (osteitis fibrosa), on the other hand, the lymphoid or fat marrow is converted into fibrous connective tissue. The old bone is destroyed by an enormous number of giant cells. Necroses play no appreciable part in this disease process. The newly formed bone, built for the greatest part by osteoblasts, persists as osteoid. The latter is found in large amounts in osteitis fibrosa or deformans. For this reason, the consistency of the bone as a whole is soft in this stage of the rebuilding process. Von Recklinghausen (24) gave the name, "metaplastic malacia" to the process. According to the quantitative relation between the production and absorption of bone, there result not only hyperostotic, but also hypostotic, pseudomalacic forms (observed by L. Pick, 20, in 1919, and E. Christeller, 4, 5, in 1920 and 1923). The hyperostotic form may be either hyperostotic-porotic, or hyperostotic-sclerotic. Up till now, no human cases of the latter have been reported, but its existence has been proved conclusively in simians. On the basis of a most thorough examination of L. Pick's material (12 cases, the majority with complete autopsy, including skeletal system), Ture Stenholm (30) in 1924 has classified the individual forms of osteitis fibrosa, or as named by him, osteodystrophia fibrosa. In this classification, Paget's disease is the generalized hyperostotic-porotic form of old age, a subdivision of osteodystrophia fibrosa.

The absolute, genetic difference must be clearly recognized between the hyperostotic form of syphilis and osteitis fibrosa, despite their apparent resemblances and gross external similarities. To a degree, there also are differences in the mode of elongation and deformity of the long bones in the two diseases. In delayed congenital lues, the elongation of the diaphysis is the result of stimulation of the epiphyses by the syphilitic osteo-periosteitis (Wieting, 32), being analagous to the increase in length of the shaft in other bone diseases which occur during the period of growth. The bone is still soft and may be involved by a rarifying osteitis. The pliability of the bone may persist until the subsequent formation of new sclerotic bone by the periosteum. Under certain conditions, the sclerotic new bone may again be replaced by a more porotic bone (compare Stadler, 29). The fibula, not being similarly stimulated, does not elongate, or at least does not elongate as much as the tibia. Therefore, the lengthened tibia of necessity must bow. Since the radius or ulna also may elongate and bow, we can readily see how unimportant a factor mechanical weight-bearing is in the production of the deformities.

Since osteitis fibrosa occurs mostly in the later years of life, after cessation of epiphyseal growth, the process resulting in elongation must be different from that in delayed congenital lues. In osteitis fibrosa, the lengthening is due to the complete rebuilding of the bone proper. There is excess new formation of bone in length as well as in width and thickness.

In cases of hyperostotic syphilitic osteomyelitis, where lues has been acquired after the growing period, the processes causing the elongation must also be of a different nature than in the congenital form. In these cases there may be a complete rebuilding of the diaphysis with destruction of the original bone structure. The lengthening results from mas-

sive new bone formation. In these particular cases, the process is genetically the same as in osteitis fibrosa. Since stimulation of the epiphyses in congenital lues may be caused by a primary simple osteomyelitis, as well as by a primary gummatous osteitis and osteomyelitis, or by a periosteitis near the epiphysis, we can easily understand why the elongation and bowing of the long bones, especially of the tibia, should be considered by some (Kaufmann, E., 13), an accompanying manifestation of gummatous osteitis, or of gummatous periosteitis) Hahn and Deycke, 11, Plate 2, Figs. 11 and 12), or by others (Axhausen, 1), as an expression of diffuse bone lues. The fibula remains straight, "stretched as the string to the bow," even when it is also involved in the syphilitic hyperostotic osteoperiosteitic process (see Stadler, 29, Hahn and Deycke, 11, Plate 2, Fig. 11, and in our material). The tibia is so much more intensely affected than the fibula, that the elongation of the former is greater than that of the latter. Therefore, despite the lengthening of the fibula, the tibia nevertheless is bowed.

In the light of these findings, we cannot deny gross morphological resemblances, particularly in the elongation and deformity of the long bones, between deforming osteitis fibrosa and hyperostotic syphilis. However, in contrast to Lannelongue and Fournier, we would not use this mere gross morphologic similarity as evidence to prove the identity of osteitis fibrosa (Paget's disease) with hyperostotic lues, nor to declare that delayed congenital lues is the pueriadolescent form of Paget's disease.

In addition to Paget's disease (the hyperostotic-porotic, senile form of deforming osteitis fibrosa), we must compare the endosteal form of osteitis fibrosa with hyperostotic bone syphilis. It has also been termed the medullary form, in contradistinction to the cortical. It apparently represents a juvenile form of osteodystrophia fibrosa (Stenholm, 30, Cases 11 and 12), and is a subdivision of the hyperostotic-porotic type. In the endosteal form the bone-rebuilding process begins at the inner surface of the corticalis, however sparing the compacta for the time being. The entire marrow cavity of the diaphysis becomes filled by a finely spongious, porous bone mass. The process extends into the epiphyses by continuity or in circumscribed isolated areas. Such foci also occur in the short cancellous bones. Despite these marked internal changes, there is no alteration in the outer form of the bone in the earlier stages of the disease. On fresh cross section, the whole diaphysis is filled up by a whitish-yellow mass resembling marzipan (L. Pick, 21). Only in a more advanced stage does the process extend into the bone, parts of which may be completely replaced. There may be flattened, hump-like elevations of the compacta, causing deformity of the bone. The surface over the elevations is finely porous. Otherwise the surface is smooth.

Thus, we have fundamentally divided osteitis fibrosa, particularly the hyperostotic-porotic senile form (i.e., Paget's disease) and the endosteal juvenile form, from hyperostotic bone syphilis. The question now arises, to what extent does the external morphological similarity of the bone changes in these two diseases manifest itself in their roentgenological relations? In other words, is it possible to make a differential diagnosis between these two diseases by means of the roentgen picture alone?

At the suggestion, and with the helpful cooperation of my teacher, Prof. Dr. Ludwig Pick, I have examined his large collection of pathological bone material in an effort to throw some light upon this question. In this work, I have utilized the method of X-raying the macerated bones (Eugen Fraenkel, 8, and L. Pick, 22) and with this means, have been able to obtain interesting and important information.

The following are three cases of osteodystrophia fibrosa, with the anatomicopathological descriptions and roentgen findings. Two are cases of the hyperostotic-porotic senile form, with sabre-tibia, i.e., Paget's disease, and the other consists of the bones of the leg of a case of osteodystrophia juvenilis (L. Pick, 21) i.e., the endosteal type. A complete description of these three cases, with full microscopic examination, is found in Stenholm's work.

CASE 1 (Stenholm's Case 2). A very small man, age 79 years, with Paget's disease (the hyperostotic-porotic, senile form of osteodystrophia fibrosa). The

Fig. 1.

Fig. 1. Photographs of sagittal sections of the tibiæ taken from (from right to left) Cases 2 and 1, hyperostotic-porotic form of osteitis fibrosa, Paget's disease, and of Case 7, syphilis.

Fig. 2.

Fig. 2. Photographs of the tibia and the fibula of Case 3, an endosteal form of osteitis fibrosa in a boy, age 15.

Fig. 3.

Fig. 3. Roentgenogram of tibia and fibula of Case 1, hyperostotic-porotic form of osteitis fibrosa, Paget's disease.

left tibia was sawed through lengthwise, and the macerated medial half (Fig. 1) is shown. The bone is 33 centimeters long from medial condyle to internal malleolus. The tibia is sabre-shaped, and is bowed with the convexity anteriorly. Its proximal two-thirds is markedly widened, while the distal shaft end is practically unchanged. The maximal breadth of the upper portion of the shaft is 5.4 centimeters. The average breadth at the distal part of the shaft is 2.4 centimeters. Distally, the corticalis and marrow cavity are normal. More proximally, the rind becomes thickened and is very markedly split up into longitudinal lamellæ and sheaths. The thickening is greatest anteriorly, reaching a thickness up to 2 centimeters. Here and there in the spongious bone mass comprising the rind, are somewhat larger cavities and perforations. The greatly widened marrow cavity is lined and partly filled by a dense network of spongious bone. At the distal end of the bone the spongiosa appears normal. The proximal part of the outer surface is flatly uneven and rough, being studded with bony protuberances, or many closely adjacent pores. The proximal part is divided from the normal distal portion of the outer surface by an elevated area running obliquely forward and down. The tuberosity of the tibia is enlarged upward to the size of a large dove's egg. In the moistly preserved preparation (the lateral half of the tibia), the meshes of the spongiosa in the marrow cavity contain yellow fat marrow.

The left fibula shows no gross pathological changes.

In the roentgenogram of the left tibia, medial one-half, only the lower epiphysis shows a normal structure (Fig. 3). The lower one-third of the corticalis shows fine longitudinally directed lamellations. More proximally, this splitting up of the rind reaches a very high degree. The structure here is very loose, so that between the dark shadows there are large areas which are wholly permeable to light. Corresponding to the enormous thickening of the proximal part of the bone, the marrow cavity is much broader here. The marrow cavity is

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 4. Roentgenogram of tibia of Case 2, hyperostotic-porotic form of osteitis fibrosa, Paget's disease.

Fig. 5. Roentgenogram of tibia and fibula of Case 3, endosteal form of osteitis fibrosa.

Fig. 6. Roentgenogram of greatly thickened tibia of Case 4, syphilis.

Fig. 7. Roentgenogram of (from left to right) left tibia and fibula, and right tibia of Case 5, syphilis.

traversed and surrounded by many trabeculæ, and only in a few circumscribed areas is the spongiosa thickened. It is particularly to be noted that the outer surface is perfectly smooth in its entire extent.

The left fibula shows no noteworthy changes except that in a few places the corticalis is thickened and shows longitudinal lamellations.

CASE 2 (Stenholm's Case 7). A very large man, age 74 years, with Paget's disease (hyperostotic-porotic senile form of osteodystrophia fibrosa). The right tibia was sawed through lengthwise; macerated medial half (Fig. 1). The bone was 44 centimeters long from medial condyle to medial malleolus. It is markedly bowed anteriorly and is sabre-shaped. The corticalis is wider posteriorly than anteriorly (2.4 centimeters as against 0.5 centimeters), and everywhere shows small longitudinal fissures and splits running parallel to the outer surface. The marrow cavity is extremely distended and extends far into the epiphysis. It is everywhere lined with a coarse network of spongiosa which in some places also bridges across the marrow cavity. The outer surface is roughened in practically its entire extent, with many hump-like, small, flat protuberances. In a rather large area, 14 centimeters below the medial condyle, it is especially rough and in the upper part of this area is perforated by many closely adjacent little holes. The largest of these have a diameter of about 0.8 centimeter. The bone rind here has a sponge-like, coarsely porous structure in its entire thickness. In the moistly preserved preparation, the lateral half of the right tibia, the roomy marrow cavity is filled with fat marrow.

The right fibula is relatively normal.

The roentgenogram of the medial half of the right tibia (Fig. 4) shows a complete rebuilding of the entire bone except for the lower epiphysis. The anterior and posterior corticalis cast a fairly dense shadow with finely lamellated, "lightened" markings, and more irregular pores. These markings in general are parallel to the long axis of the bone. At the point of the greatest convexity, anteriorly, the shadow

has a blistered appearance. A similar prominent outgrowth is found on the posterior surface in its upper one-third. Nowhere is there a shadow of periosteal thickening. The numerous larger and smaller illuminated areas often fairly well circumscribed represent fat masses as were seen in the moistly preserved specimen.

CASE 3 (Stenholm's Case 9 Fig. 3). A 15 year old boy, with the juvenile endosteal form (L. Pick) of osteodystrophia fibrosa. The right tibia was sawed through lengthwise; anterior half macerated. The bone was 36 centimeters long from medial condyle to internal malleolus; width, mid-portion, 2.4 centimeters. The bone is lengthened, but there is no bowing. On the external surface there are three flat elevations which together take in the entire length of the shaft. On the middle elevation the medial part of the surface is porous, but the rest is smooth and unchanged. The middle portion of the marrow cavity is evenly filled by a very fine spongious bone mass. It also extends proximally and distally, but here it leaves the most central portion of the marrow cavity unchanged. Several isolated circumscribed foci about the size of a hazelnut, composed of this dense spongious bone mass, are found in the proximal epiphysis. The corticalis for the most part is fairly thin, not exceeding 0.4 centimeter in thickness. It is especially thin in the upper lateral portion, and in the area at which the surface is porous, the corticalis is completely gone.

The right fibula was sawed through lengthwise; medial half macerated. It measured 33 centimeters long. The bone is diffusely widened except for the most proximal segment. It is 1.9 centimeters broad in the mid-portion. The entire marrow cavity except at the epiphyses is filled up by a finely spongious bony network which is coarser than that seen in the tibia. There is a focus of similar structure about the size of a bean in the spongiosa of the distal epiphysis. The corticalis has a maximal thickness of 0.3 centimeter, but is mostly very thin, often being as thin as paper. The outer surface is finely porous here and there; otherwise, the remainder is smooth and unchanged.

In the moistly preserved half of the tibia, the spongious bony ingrowth into the interior of the bone is represented by a uniform yellowish-white mass resembling marzipan.

The roentgenogram (Fig. 5) shows the right tibia, anterior half, and the right fibula, medial half. The tibia is much less permeable to light than the fibula. The fibula shows a diffuse central shadow with very fine markings and lighter areas. Portions of the corticalis are replaced by this shadow. The remainder is dense and thin. The tibia shows coarser bone trabeculæ and also more solid masses. Its corticalis is thin, and in places is entirely gone, merging into the dense solid shadow. Isolated dense foci are seen at the proximal end of the tibia and at the distal epiphysis of the fibula. The proximal and distal epiphyses of both bones and a small part of the tibial diaphysis adjacent to the distal epiphysis

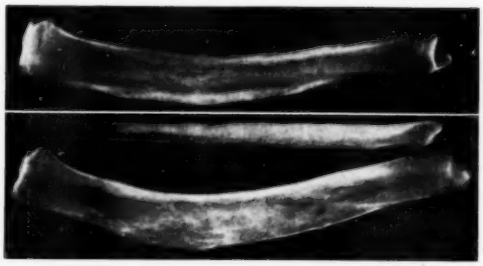

Fig. 8 (above). Roentgenogram of tibia of Case 6, syphilis.
Fig. 9. Roentgenogram of tibia and fibula of Case 7, syphilis.

(metaphysis) cast a relatively normal shadow. The remaining portions of both bones are completely rebuilt. Despite this tremendous change in the architecture of the bones, their outer surfaces are perfectly smooth. There is no periosteal shadow at any place.

The chief characteristic of the anatomical and roentgenological findings in these cases is the complete absence of any periosteal participation. Even though the outer surface of the bone is uneven, parts being covered with flattened elevations and protuberances (as in the first case of Paget's disease), the roentgen picture (Fig. 3) nevertheless shows that these outgrowths doubtlessly are purely cortical in nature. In the third case, the juvenile form, the periosteum is also entirely uninvolved despite the enormous endosteal formation of bone which has filled up the marrow cavity and has partly replaced the corticalis up to the periosteum, even causing a humplike elevation of the latter.

The second important feature is the state of the marrow cavity. In the first two cases (as seen in the photographs of the cross sections of both the tibiæ, Fig. 1, and especially in their roentgen pictures, Figs. 3 and 4), the marrow cavity is markedly widened, and particularly in the second case, so roomy that it extends far into the epiphyses. Even when a portion of the marrow cavity is partly filled up by a newly formed dense spongiosa, it contains only yellow marrow, as demonstrated in the moistly preserved half of the bones. In the endosteal form the marrow cavity is diffusely filled by the characteristic marzipan-like mass. It is very important to note that this marzipan-like bone may form in still un-

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 10. Photograph of Case 8, syphilis.
Fig. 11. Roentgenogram of left tibia and fibula of Case 8.
Fig. 12. Roentgenogram of right tibia and fibula, Case 8.
Fig. 13. Roentgenogram of left forearm of Case 8.

involved areas of the spongiosa as circumscribed isolated foci up to the size of a hazelnut; also in flat cancellous bones, such as the vertebræ. Such foci may be seen in our case in the proximal epiphysis of the right tibia or in the distal extremity of the right fibula. They are excellently shown in the roentgen pictures.

The third important point is the appearance of the rebuilt bone substance. In the endosteal type of osteitis fibrosa (Case 3) it is finely spongious and densely porous, being of greater density in the tibia than in the fibula. A different condition is found in the two cases of senile osteitis fibrosa with sabre tibiæ (Paget's disease). In Case 2 the rebuilt corticalis in general is compact, though it is traversed by numerous fissures and cracks arranged parallel to the outer surface. In Case 1 the corticalis is split up into larger lamellæ which also run parallel to the outer surface. These lamellations have a very characteristic appearance in the roentgenogram. The finely porous character of the outer surface may be accentuated to form larger, coarser perforations, as in Case 2. These as readily seen are purely osteitic in nature and have nothing to do with any periosteal involvement.

For comparison with these anatomical and roentgenological pictures of osteitis fibrosa, we are presenting the following four syphilitic tibiæ, some also with the fibula. Three of the preparations have been macerated, and the fourth, moistly preserved. The syphilitic nature of the bone changes in these specimens has been proved by the other autopsy findings, except in Case 7, in which the bones alone were removed for examination.

Case 4. Collection No. 1909/207. A shoemaker, age 59 years, who was homeless, had slept outdoors on a cold December night. He was almost frozen

when admitted to the hospital, and died with signs of pneumonia. At autopsy (No. 1909/1215, Prof. Dr. L. Pick) the following was found: (1) obliteration of both pleural cavities; (2) widespread tuberculous bronchopneumonia of both lungs, with many areas of purulent softening in the right upper lobe; (3) purulent tracheitis and bronchitis; (4) numerous tuberculous ulcers in the large intestine; (5) amyloidosis of the liver, spleen, and kidneys; (6) peptic ulcers in the duodenum (2); (7) mesaortitis syphilitica; (8) fibrous orchitis; (9) right tibia on palpation was greatly thickened and the surface irregular. There were widespread varices on the left leg. Both tibiæ and fibulæ were removed and macerated.

The right tibia was sawed through in sagittal plane. It measured in length, 38 centimeters; in width, 5.5 centimeters; in thickness (A.-P.), up to 5 centimeters. It weighed 500 grams.

The right tibia is greatly thickened in its entire length and is very heavy. A small portion of the outer surface is smooth. The greater part especially on the lateral aspects is rough, being covered by many sharp-edged scales, spicules, and dentate projections. These are often confluent, forming bony bridges and ridges. In a few areas the surface has a dense porous appearance. On cross section, both ends of the bone are normal in structure. The diaphysis is composed of a dense spongious central portion and two broad, very compact corticalis sheaths. The latter are about 1.5 centimeters wide and are more or less eburnated, with solitary finely porous areas. There is no actual marrow cavity. In the proximal portion of the diaphysis, the central spongy bone is so dense that it is continuous with and practically indistinguishable from the corticalis. The thick anterior corticalis sheath begins 3 centimeters above the distal epiphysis. Below this it merges into normal corticalis.

The right fibula was sawed through in sagittal plane. It measured in length, 37.5 centimeters; in width, 2.3 centimeters, and weighed 155 grams. In its proximal three-fourths, the right fibula shows changes similar in degree and character to those seen in the right tibia. The distal one-fourth is normal, both externally and on cross section. The proximal three-fourths of the outer surface is very rough with many scales, ridges, and dentate exostoses. On cross section the proximal epiphysis is composed of spongiosa. The rest of the pathologically altered diaphysis shows the same three zones (corticalis and central spongiosa) as seen in the tibia. In the distal part of the diseased diaphysis, the three zones become equally dense and indistinguishable from one another.

The left tibia was sawed through in sagittal plane. It measured in length, 38 centimeters; in width, 2.3 centimeters (maximal, right to left); thickness (anteroposterior) 4 centimeters (maximal); and weighed 240 grams. The left tibia is markedly flattened from side to side and is only slightly heavier than normal. The surface for the most part is smooth. On cross section there is slight thickening of the posterior corticalis. The anterior corticalis is markedly thickened (up to 1.5 centimeters). The maximal thickening is about 12 centimeters distal to the proximal epiphysis, and causes a pseudo-bowing of the tibia anteriorly. At this point the anterior surface is slightly roughened over an area 4.5 centimeters in diameter.

Left fibula weighed 48.5 grams, was 38 centimeters long and showed no pathological changes (Fig. 6).

On the roentgenogram, the upper and lower epiphysis of right tibia show no changes. The marrow cavity is filled by a fairly dense porous mass casting alternating dark and light shadows. The original corticalis shadows can be recognized as a central shaft enveloped by an enormous periosteal thickening. The latter reaches a thickness of 25 millimeters. Its border is very irregular with many indentations and comb-like projections. The periosteal shadow is for the most part quite dense, but here and there is maculated by light and dark areas. The fine pores are often directed lengthwise, parallel to the shaft. The corticalis can be distinguished from the periosteum and marrow cavity by the greater density of its shadow, but gradually it merges into them. The most distal part of the bone, for a distance of 4 centimeters, is free from periosteal deposit.

Case 5. Collection No. 1910/139. (Autopsy No. 1910/861 by Prof. Dr. L. Pick.) Patient was a laborer, aged 22. The important findings at autopsy were: fibrinous pneumonia of entire right lung and left lower lobe; recurrent verrucous mitral endocarditis; fresh fibrinous pleuritis of right lower lobe; parenchymatous degeneration of heart muscle; both tibiæ were diffusely thickened and somewhat bowed anteriorly; a sharp edge could not be felt anteriorly. Bones of both legs were removed and macerated. The right tibia was preserved *in toto*. It measured in length 36 centimeters; in breadth (right to left) 4.3 centimeters; in thickness (anteroposterior), 4.3 centimeters.

Only the epiphyses and the lower shaft end appear relatively normal. The remaining portion of the bone is markedly, and somewhat unequally thickened. The greatest part of the outer surface is covered by many fine and coarse lacunæ and larger furrows. These furrows are directed parallel to the long axis of the bone.

The right fibula was preserved *in toto*. It measured in length 35 centimeters. There are no pathological changes except for two small rough areas on the outer surface of the distal part of the shaft.

The left tibia was sawed through in sagittal plane. It measured, in length, 38 centimeters; in breadth (right to left) 4+ centimeters; in thickness (anteroposterior), 4.5 centimeters. The appearance of the outer surface is similar to that of the right tibia. Especially to be noted is that the direction of the grooves and furrows is lengthwise, parallel to the long axis of the bone. A portion of the outer surface, about 6 centimeters long, at the proximal end of the diaphysis, is smooth and shows no changes. Cross section shows the marrow cavity

preserved, except for an area 7 centimeters long at the junction of the middle and lower third of the tibia, where the marrow cavity is filled by a closely meshed spongiosa. The anterior corticalis is thickened 22 millimeters. The maximal thickening is at about the middle of the bone, and causes a slight anterior bowing. The posterior corticalis is thickened, though less than the anterior, up to 17 millimeters. The maximal thickness corresponds to the point at which the entire marrow cavity is filled by spongiosa. The spongiosa here gradually merges into the corticalis and cannot be distinguished from it. In the upper one-third of the diaphysis the posterior corticalis is relatively normal. The anterior and posterior corticalis are compact, showing in places fine and coarser pores. Any further distinction of the bone sheaths cannot be made grossly. The epiphyses are normal.

The left fibula was preserved *in toto*. It was 36 centimeters long. Chiefly the lower half is thickened. Especially in this area is the outer surface roughened with many depressions and furrows, having an appearance similar to that of the tibia. Likewise, the direction of the furrows is parallel to the long axis. The epiphyses are free from change.

The roentgenogram (Fig. 7) shows the right tibia, left fibula, and lateral half of left tibia. The marrow cavity of right tibia in the greater portion of the diaphysis has almost entirely disappeared. The bone shadow in parts is very dense. At other places, there are many lightened areas representing the furrows which are directed longitudinally, parallel to the long axis of the bone. At the proximal end posteriorly, the corticalis is easily recognized. It is also well seen at the distal end anteriorly, and to a lesser degree posteriorly. Anterior to the corticalis which is composed of fairly firm bone, there is a wide shadow more porous in structure, which is due to periosteal deposition. Posteriorly, there is a similar, but lesser periosteal thickening. Toward the central portion of the bone, the corticalis shadows gradually merge with the shadows of periosteal thickening and of the obliterated marrow cavity, so that they can hardly be distinguished from each other. The epiphyses are normal.

The picture of left tibia shows that the bony thickening is chiefly periosteal. The corticalis, especially posteriorly, is sharply defined from the periosteal thickening in almost its entire length. This can also be seen anteriorly, except in the central portion where the marrow cavity is filled up with spongy bone. The periosteal thickening anteriorly is more coarsely porous than posteriorly. In the latter, parallel lamellated markings are clearly seen. In the mid-portion of the bone where the marrow cavity is obliterated, the anterior corticalis, and to a slight extent the posterior, splits up and merges into the general porous bony structure.

The lateral side of the left fibula shows extensive similar changes. In the distal half of the diaphysis the corticalis has a lamellated appearance, the markings being directed lengthwise. The periosteal deposit (5 millimeters thick) is sharply defined from the corticalis by a dark line. Such a sharp line of demarcation cannot be seen in the proximal half. Here there is marked generalized thickening of the corticalis with fairly distinct longitudinal lamellations running parallel to the long axis of the bone.

CASE 6. A laborer, age 29 years, with the diagnosis of pneumonia and "liver trouble." At autopsy (Prof. Dr. Von Hanseman No. 1875/178) the following was found: (1) lungs: showed tuberculous bronchopneumonia in left upper lobe with miliary tubercles on the left pleura. Fresh bronchopneumonic areas in both lungs. "Syphilitic" scars (interstitial pneumonia), left lower lobe; (2) fatty liver; (3) left kidney, pea-sized gumma in cortex; (4) tongue was smooth with "syphilitic" scars; (5) right tibia was bowed anteriorly, and on palpation was greatly thickened with rough protuberances. The tibia was removed. It was very heavy.

The right tibia (Specimen No. 1895/75, was moistly preserved and sawed through in sagittal plane. It measured in length 38 centimeters; in width (right to left), 3.5 centimeters (maximal); in thickness (anteroposterior), 5.5 centimeters (maximal). The right tibia is moderately bowed with the convexity anterior. There is marked lateral flattening (sabre form). The outer surface is smooth, except for small areas, where there are fine pointed and flattened excrescences. On cross section, the posterior corticalis is compact, except for small localized porous areas, in which the bone is slightly split up. The posterior corticalis is thickened up to 1 centimeter.

The anterior corticalis is recognizable as such, only in the distal end of the tibia. Above, it merges into a very dense spongious bone structure. This dense spongiosa extends upward and with the exception of small areas obliterates the entire marrow cavity.

Anterior to this, and corresponding to the convexity of the tibia, there is an eburnated new corticalis sheath, extending almost the entire length of the bone, apparently built from the periosteum. Its maximal thickness is 13 millimeters. The epiphyses are free.

On the roentgenogram, the upper and lower epiphyses of right tibia appear normal (Fig. 8). No marrow cavity can be seen, but instead there is a shadow of dense spongiosa. In the proximal half, the markings of the meshes of the spongiosa are directed lengthwise, parallel to the long axis of the bone. The original corticalis is preserved with normal appearance only in the distal one-fourth of the bone anteriorly and posteriorly, and at the proximal extremity posteriorly. The remainder of the corticalis is split up into dense longitudinal lamellæ. The shadow of the original tibia is so clearly seen in the roentgenogram that one can easily recognize that the thickening of the bone is chiefly due to periosteal deposition. Anteriorly, the maximal periosteal thickening is 23 millimeters; posteriorly, over 5 millimeters. Most anteriorly, the periosteal deposit casts a very dense shadow over 1 centimeter broad. Behind this, it becomes more porous, gradually merging into the similarly constructed anterior corticalis. The pos-

terior periosteal shadow also varies in density. In the upper one-third, a coarsely porous, cockscomb-like protuberance is seen. The marked anterior bowing is almost entirely due to periosteal thickening. The original tibia, as seen by its shadow, is only very slightly bowed.

CASE 7. A shoemaker, age 31 years, died of hæmoptysis due to pulmonary tuberculosis. At autopsy, by Prof. Dr. L. Pick, the following was noted: Both bones were bowed markedly, with the convexity anteriorly. The bones of both legs were removed and macerated. The right tibia (collection No. 1909/112, Fig. 1, was sawed through in the sagittal plane). Its length was 41 centimeters; width (right to left, greatest diameter), 4 centimeters; thickness (anteroposterior), 5 centimeters; weight, 440 grams.

The right tibia is heavier than normal, thickened throughout, and markedly bowed with anterior convexity. The lateral aspect of the outer surface in the middle one-third is extraordinarily finely porous with moss-like rough excrescences and some larger stalactite growths. The remaining surfaces are smoother, especially at the ends of the bone, but nowhere are they entirely free from change. On cross section, the posterior corticalis is compact and unchanged save in the mid-portion of the bone, where here and there it has a finely porous structure. The greatest width of the posterior corticalis is 7 millimeters. The anterior corticalis presents an entirely different picture. Only at the distal end is it thin. The remaining corticalis is widened and split up into a fine lamellated structure, forming a meshwork. The meshes are flattened and are directed lengthwise.

The marrow cavity is approximately normal in width, except that it is partly and at the point of greatest convexity entirely filled by spongiosa. The epiphyses are normal.

The right fibula was sawed through in the frontal plane. Its length was 38.5 centimeters; width (right to left greatest diameter), 2.4 centimeters; weight, 140.0 grams. The right fibula is greatly thickened and heavier than normal. The outer surface in its upper two-thirds is very rough and uneven with many pointed comb-like excrescences. The surface between the latter has a finely porous, pumice-stone-like appearance. Toward the distal end the surface is smooth. On cross section, the medial corticalis is compact and only slightly thickened. Its maximal thickness is 4.5 millimeters. The lateral corticalis is also compact, but almost uniformly thickened up to about 12 millimeters. Most of the marrow cavity is filled by spongiosa so that only a small part of actual cavity remains. The epiphyses are normal.

The left tibia was sawed through in sagittal plane. Its length was 41 centimeters; width (right to left greatest diameter), 3.7 centimeters; thickness (anteroposterior), 5.1 centimeters; weight, 427 grams. The left tibia is thicker and heavier than normal and is bowed convex anteriorly, though to a lesser degree than the right tibia. The outer surface in general is similar to the right but is less rough. On cross section, the posterior corticalis is compact, being 5 millimeters thick. The greatest part of the anterior corticalis is compact, but in a few places it has a lamellated porous structure, the long diameter of the meshes being directed parallel to the long axis of the bone. It is about 15 to 17 millimeters thick. The marrow cavity is of normal width. At the point of greatest convexity, i.e., the junction of the upper and middle thirds, it is completely filled by spongiosa. The epiphyses are normal.

The left fibula weighs 40 grams, is 37.5 centimeters long, and shows no gross changes.

On the roentgenogram, the upper and lower epiphyses of right tibia are free (Fig. 9). The posterior corticalis is preserved in general as a fairly uniform dense shadow. The entire remaining area is finely porous, with single areas of diffused lightening representing the larger coarser pores. In the lower half, there is a very dense narrow shadow at the anterior border.

The anterior border is a little wavy, but smooth. At the posterior border, in the upper one-third, there is a fine, wart-like periosteal shadow. A little below the middle there is a narrow periosteal deposit 6.5 centimeters long. The distal half of right fibula is diffusely thickened. Its shadow is very dense, here and there being speckled with lighter areas. Toward the proximal end of the bone, the lateral corticalis splits up into a fine spongiosa. It is well demarcated from the more lateral, dense periosteal shadow. Just distal to this, the corticalis and periosteum merge indistinguishably into a dense shadow. The proximal half of the medial corticalis is unchanged. Its distal portion is merged in the dense shadow of the distal half. Both borders are irregularly serrated. The epiphyses are relatively normal.

In this group of cases, the method of X-raying anatomical bone specimens particularly proves its value; for with no other method of gross or microscopic examination, can we so beautifully demonstrate the marked degree to which the periosteum participates in the deforming, new bone building processes.

Whereas Hahn and Deycke (11) emphasize that the bone thickening in diffuse osteoplastic syphilis of the long bones is chiefly of osteitic origin, and that only here and there is any periosteal involvement demonstrable, our findings in Cases 4, 5, 6 contradict these statements. In every one of our 3 cases (4, 5, 6) the thick periosteal bone mantle (so colossal in Case 4) is well shown by the roentgen pictures. Furthermore, they show that the diaphysis of the tibia which is enclosed by this periosteal mantle, plays a lesser rôle in the tremendous thickening. In all 3 cases the shadow of the original corticalis is clearly

seen, and its line of demarcation from the surrounding periosteal bone sheath may be followed with great, or at least sufficient, distinctness. The marrow cavity in all 4 cases (4, 5, 6, 7) is more or less obliterated, being filled by a dense, newly formed bone mass. In the latter, the axially directed fissures, as observed by Hahn and Deycke, are very distinctly seen. The compacta, except in small areas where it is still originally intact, shows similar characteristic markings in the roentgen picture. They also are seen in the shadow of the periosteal thickening in Case 5. In Case 4 the periosteal shadow is much more irregular, whereas in Case 6, corresponding to the convex surface of the tibia, it is bordered off by a very dense band-like shadow in the manner of a new outer compacta. This sabre-like bowed tibia (Case 6) coincides with Fournier's picture. The bowing is only seeming, for in reality the tibia is straight with an anterior periosteal hyperostosis. This is clearly shown by the roentgen picture (Fig. 8). On the other hand, Wieting (32) (cited by Stadler, 29) has demonstrated the occurrence of real sabre-like bowing of the bone. Our Case 7 shows an actual bowing of the tibia and, taken in conjunction with Case 6, demonstrates that tibia *en lâme de sabre* (Fournier, 6) occurs in two forms: the pseudoform, with a straight diaphysis, and the real form, with a bowed diaphysis.

In this last case of syphilis (7), in which the fibula is also involved by an ossifying osteoperiosteitis, its marrow cavity has totally disappeared in the roentgen picture, as in the other cases. The entire tibial diaphysis except for a small portion of the posterior compacta is completely replaced by a loose, and in parts denser, spongy bone structure. The axial direction of the meshes in this newly built spongiosa is very well marked. In this case it is impossible to divide the purely periosteal from the osteal portion, thus corresponding to the state pictured by Hahn and Deycke. Only in the concavity of the tibia, in the area where the posterior compacta is still preserved, does the roentgen picture show a narrow dense periosteal shadow, sharply set off from the compacta.

A careful comparison of the anatomical and roentgenological findings in the long bones of the hyperostotic form of lues, with those of the senile hyperostotic-porotic form of osteitis fibrosa (Paget's disease), as well as with the juvenile endosteal form (L. Pick), has brought out these fundamental differences:

1. Usually marked, and sometimes tremendous participation of the periosteum in the deforming bone building process in lues as compared to the absolute passivity of the periosteum in osteitis fibrosa.

2. Marked, uneven, widening of the marrow cavity in Paget's disease, compared with more or less complete bony obliteration of the marrow cavity in lues.

3. Lamellary splitting up of the corticalis in certain of the cases of Paget's disease, compared with the characteristic axially directed arrangement of the meshes of the newly formed hyperostotic bone in lues. This latter arrangement is also found in certain cases of Paget's disease (Case 2), but in these cases, the widened state of the marrow cavity and the absence of any periosteal involvement are diagnostically decisive. Since the periosteum is passive in osteitis fibrosa, the pseudoform of tibia *en lâme de sabre*, of course, cannot occur in these cases. Thus we have found real differences along several lines.

However, it cannot be denied that there is great similarity between the anatomical and roentgenological findings in cases of the juvenile endosteal form of osteitis fibrosa (Case 3), and those cases of hyperostotic bone syphilis in which it is impossible to prove that the periosteum participates in the new bone building process (Case 7). At the present time it is not known whether the sabre form of tibia occurs in the juvenile endosteal form of osteitis fibrosa, but of course such a possibility cannot be excluded. In all events, in both diseases there is a complete replacement of the original preformed bone—both of the marrow cavity and the compacta—by an osteitic new bone formation. These cases undoubtedly correspond to those spoken of by Axhausen (1) in which the bone surface appears smooth, and in which periosteal involvement cannot be satisfactorily demonstrated. However there are two other characteristic findings in juvenile osteitis fibrosa which afford us further means for differentiation.

1. The tendency toward the formation of cysts in the newly built fibrous osteoid mass which, particularly in this juvenile type, are not infrequently encountered.

2. The occurrence of isolated and dense spongious foci in otherwise uninvolved spongy bone.

The roentgenological demonstration of either of these changes would permit us to exclude lues. In doubtful cases, the clinical picture, the Wassermann, and biopsy are additional aids toward making a differential diagnosis.

However, apart from the difficulties in diagnosis in the juvenile form of osteitis fibrosa, we are able to differentiate the hyperostotic deforming type of syphilis of the long bones from osteitis fibrosa deformans by means of the roentgenogram alone.

This is excellently illustrated by the following, clinically observed case:

CASE 8[1]. A man, age 43 years, factory inspector, was admitted May 5, 1923 to the 2nd Medical Service (Prof. Richter). Patient's father died at 56 of dropsy; mother was never ill. He has five brothers and sisters; several died at birth and the rest in the first year of life. Patient is youngest child. The mother had a positive Wassermann.

The patient does not remember any diseases of childhood. At the age of 6 he slipped while playing, and fractured his right femur. The fracture healed well. At the age of 14 he suddenly had a paralysis of the muscles of the right arm and right side of the neck. The right arm paralysis remained, the musculature becoming atrophied. Several weeks after the onset of paralysis, he noticed a hard "bony" mass on the right lower arm, which in a short time enlarged to its present size and appearance. After several months, similar hard swellings were noticed on both tibiæ. On the right side the tibia became bowed and shorter in length. The hard swellings on the tibiæ increased in size until his eighteenth year. At that time he was in an institution for crippled, and was being treated by massage and movement. Patient denies venereal disease and has never had any antiluetic treatment. Patient was admitted to the hospital for a supposed "grippe."

Physical examination. Patient is moderately well built male, 175 centimeters tall, pale, but quite strong. In general, the bones and muscles are gracile. His skull shows a large external occipital protuberance. It is somewhat oxycephalic, his brow being a little recessive. The pupils are unequal, irregular, and react to light and accommodation. There is slight scoliosis of upper thoracic spine to the left; a lesser scolosis (compensatory) to the right, below. The spinous processes of the eleventh and twelfth thoracic vertebræ are thickened. The clavicle is also thickened. The epigastric angle is acute and narrow. The thorax is flat and long. The whole right side appears smaller, and expands less with respiration. The borders of the lungs are low on both sides and move moderately with respiration. The breath sounds are vesicular. No dullness. The heart sounds are regular and clear. The abdomen is soft; the organs negative. The liver and spleen are not palpable.

The right arm is held in adduction and is sharply flexed at the elbow. The hand is held in volar flexion, pronation, and abduction. The index finger is held straight. The other fingers are slightly flexed. The musculature shows a marked degree of atrophy and is spastically paralyzed. The scapular musculature is atrophied. The humerus is 36.5 centimeters long; radius, 27.5 centimeters; the ulna, 24.5 centimeters; circumference of forearm, maximal, 20 centimeters; distal end, 13 centimeters.

The left upper arm and hand are normal except that the little finger is in the hammer position. The left forearm is markedly deformed. The distal end of the radius and the proximal end of the ulna are thickened, being club-like in shape with uneven protuberances. Dorsal flexion of the hand is possible only to the horizontal plane. Pronation and supination are limited. The humerus is 38 centimeters; the radius, 29 centimeters; the ulna, 28 centimeters. The circumference, at proximal end, 19.5 centimeters; distal, 19.5 centimeters.

The gait is rapid and sure. Both thighs are normal. The quadriceps muscles are well developed. Both legs are markedly deformed. The tibiæ are felt thickened and "bumpy," though they cannot be sharply palpated. The tibiæ are bent forward and outward. The right foot is rotated outward in the planovalgus position.

Measurements:

	Right cm.	Left cm.
Length: Anterosuperior spine to calcaneus	100	106
Lower border patella to external malleolus	44	45.5
Circumference of leg 7 cm. below patella	39	42
Middle of calf	34	40
Malleolus	30.5	29

The patellar and Achilles reflexes are active and equal. Babinski of right leg questionable; right triceps and radial periosteal reflex increased.

Examination of urine and stool was negative. Wassermann was strongly positive.

Roentgenograms of left tibia and fibula (Fig. 11), show the left tibia very markedly bowed with convexity anterior, while the fibula is straight. The tibia shows extensive changes especially in the anterior half, where it casts a large dense shadow, with only a few, and relatively insignificant lightened-

[1] Presented by P. F. Richter and L. Pick (26) before the Berl. med. Gesellsch., June 6, 1923.

up areas. More anteriorly, toward the skin, it becomes less compact and irregular, with fine irregular frayed projections. Posteriorly, this deep shadow has a cloudy irregular border. The posterior corticalis can be distinctly seen. Distally, at the posterior border, there is a small narrow periosteal deposit. There is no actual marrow cavity but instead, the general bony structure is lighter and spongy in character. The markings of the meshes are directed lengthwise. The epiphyses appear normal.

On the anterior surface of the distal two-thirds of the left fibula, there is a fairly dark, flattened, wavy, periosteal shadow. Distally on the posterior surface, there is also a small periosteal shadow. The anterior and posterior corticalis and the marrow cavity are well defined.

The picture of the right tibia and fibula (Fig. 12) is very similar to that of the left leg; the tibia, however, being less bowed. The fibula is straight. Similarly, there is a dense shadow on the anterior part of the tibia, but it extends further posteriorly in the distal one-third and in the upper half than on the left. Posteriorly, the shadow has an irregular nebulous appearance. On the posterior surface there is a narrow periosteal shadow. Otherwise the right tibia is very much like the left.

The right fibula shows more marked changes than the left. In the proximal three-fifths, the corticalis and marrow cavity are clearly defined. Both anteriorly and posteriorly there are periosteal thickenings. In the distal two-fifths, the fibula is thickened to about three times its normal size, and casts a dense shadow with a few small diffuse "lightened" spots. The borders are irregularly serrated and frayed.

Both bones of the left forearm (Fig. 13) are deformed and diffusely thickened. Both cast very dense shadows with small lightened areas, especially in the lower ends. On the adjacent surfaces of the radius and ulna, there are irregular, serrated, and frayed periosteal deposits. The proximal one-third of the radius casts a lighter shadow. Here, the corticalis and marrow cavity can be recognized, though the marrow cavity is filled by the shadow of a finely porous bone mass. In this region, on the lateral surface, is a fairly dense shadow of periosteal thickening separated from the corticalis by a distinct dark cleft.

The bones of the right forearm are thin and atrophic, and show a fairly normal corticalis and marrow cavity. On the medial border of the radius in the upper one-third, the shadow of the corticalis becomes less compact and merges into a flat, hump-like periosteal shadow of lesser density. Otherwise there are no pathological changes.

This clinical picture is certainly most unusual. In addition to the deformity of the right arm, the result of a cerebral paralysis luetic in childhood, there are the marked anterior outward bowing of both legs, the easily palpable coarse changes of the sabre tibiæ, and the enormous thickening of the bones of the left forearm. Even without the strongly positive Wassermann reaction, the syphilitic nature of these bone changes can be readily determined from the roentgen pictures alone (Figs. 11, 12, 13). We have seen the tremendous osteoperiosteitis of both bowed tibiæ; the osteoperiosteitis of the straight right fibula, as well as bony periosteitis of the left fibula; the diffuse osteoperiosteitic hyperostoses of the left forearm bones, and the marked outward bowing of the radius because of its increased length. In the proximal third of the atrophic right radius, there also was a bony periosteitis.

Peculiar to the changes in these sabre tibiæ is the excessive participation of bone and periosteum in the anterior circumference. In the posterior circumference of the left tibia, remains of the original compacta can still be recognized. Here, also, a portion of the original marrow cavity is preserved. The characteristic axial arrangement of the meshes of the newly built bone filling the marrow cavity of the right tibia, is very clearly seen in the roentgen picture. Thus, in addition to the periosteal involvement and the obliteration of the marrow cavity, the third diagnostic characteristic of syphilitic hyperostosis also is present.

The combination of elongation and bowing of the radius, with bilateral sabre tibia, makes this the counterpart of the case of congenital lues observed by Stadler (29).

CONCLUSIONS

1. There are gross anatomical and clinical resemblances between the hyperostotic form of syphilis of the long bones and osteitis fibrosa, both the senile hyperostotic-porotic form (Paget's disease), and the juvenile endosteal type (L. Pick). Coarser gross morphological similarities, such as deformities, elongation and bowing, and especially, the sabre blade form of tibia, are found in the affected bones of both diseases.

2. Despite these external similarities we are dealing, especially in regard to their histogenesis, with two fundamentally different diseases. The essential differences in their nature express themselves in the individual anatomico-pathological characteristics of the affected bones, and also in their roentgen pictures.

3. Characteristic of hyperostotic syphilis are: (a) the marked, often tremendous, participation of the periosteum; (b) the more or less advanced narrowing and obliteration of the marrow cavity; (c) the sclerotic or finely porous quality of the newly built bone tissue. The meshes or pores particularly in the roentgen pictures seem to be directed lengthwise, parallel to the long axis of the diaphysis.

The sabre blade or sabre sheath form of tibia in syphilis may be due purely to a periosteal new formation of bone, i.e., a pseudobowing (Fournier); or to an osteitic rebuilding and elongation, resulting in a true bowing (Wieting).

4. Characteristic of the senile hyperostotic-porotic form of osteitis fibrosa (Paget's disease) are: (a) the absence of periosteal participation; (b) the very great widening of the marrow cavity, even into the epiphyses; (c) the frequent lengthwise splitting up of the compacta into lamellæ. The sabre blade tibia of Paget's disease is the result of the rebuilding and elongation of the bone, i.e., a true bowing.

5. In the juvenile endosteal hyperostotic-porotic form, there also is a complete absence of periosteal involvement. Only these latter cases may be difficult to distinguish roentgenologically from congenital bone syphilis.

The occurrence of more or less well formed cysts, or of single, circumscribed, dense foci accompanying a diffusely spreading osteitic new bone formation, are diagnostic points in favor of osteitis fibrosa, as against lues. In the remaining still doubtful cases, additional clinical methods should be employed to arrive at a diagnosis.

REFERENCES

1. Axhausen, G. Beitraege zur Knochen und Gelenksyphilis. Berl. klin. Wchnschr., 1913, li, 2361.
2. Benazet, Ed. Syphilis héréditaire tardive des os long chez l'enfant et chez l'adolescent. Paris: 1911.
3. Bloodgood, J. C. Benign bone cysts, osteitis fibrosa, giant cell sarcoma and bone aneurysm of the long pipe bones. Ann. Surg., 1910, lii, 145.
4. Christeller, E. Vergleichend Pathologisches zur Rachitis, Osteomalazie und Ostitis fibrosa. Berl. klin. Wchnschr., 1920, xli, 979.
5. Idem. Die Formen der Ostitis fibrosa und der verwandten Erkrankungen der Saeugetiere. Ergeb. d. all. Path. u. path. Anat., 1923, xx, 1.
6. Fournier, A. La syphilis héréditaire tardive. Paris: 1886.
7. Idem. Apropos de maladie de Paget considérée comme manifestation de syphilis héréditaire tardive. Ann. de chir. et de orthop., 1903, pp. 115–132.
8. Fraenkel, E. Die kongenitale Knochensyphilis in Roentgenbilde. Fortschr. a.d. Geb. d. Roentgenstr., 1911, xxvi.
9. Frechon, J. Des rapports de l'hérédosyph, oss. tard. avec l'osteite de'f. progr. Paris: 1903.
10. Fritsch, K. Die Tibia "en lâme de sabre" als Folge der erworbenen Lues der Erwachsenen. Fortschr. a.d. Geb. d. Roentgenstr., 1910, xvi, 123.
11. Hahn, R.-Deycke-Pascha. Knochensyphilis im Roentgenbilde. Fortschr. a.d. Geb. der Roentgenstr., 1907, xiv.
12. Hutchinson, J. Osteitis deformans. Med. Press, 1897, cxv, 366.
13. Kaufmann, E. Lehrbuch der speziellen pathologischen Anatomie., 7th and 8th ed., 1922.
14. Krayn, M. Ueber die Roentgendiagnose der Knochensyphilis, bes. d. Dactylitis syphilitica, I-D, Breslau, Nov., 1919.
15. Lannelongue. Note sur la syphilis osseuse héréditaire, etc. Acad. de méd. 1903, Mar. 3. Gaz. d. hôp., 1903, lxxvi, 268.
16. Ménétrier and Gauckler. Deux cas de maladie osseuse de Paget avec examen anatomique. Bull. et mém. soc. méd. de hôp de Paris, 1903, xx, 574.
17. Mikulicz, J. von. Ueber zystische Degeneration der Knochen. Verhl. d. Ges. deutsch. Naturf. u. Aerzte, 1904, lxxvi, 107.
18. Paget, J. On a form of chronic inflammation of the bones (osteitis deformans). Med.-Chir. Tr., 1877, lx, 37.
19. Idem. Additional cases of osteitis deformans. Med.-Chir. Tr., 1882, lxv, 225.
20. Pick, L. Verein zur Pflege der vergleich. Path., 1914, Apr. 24. Berl. klin. Wchnschr., 1919, lvi, 765.
21. Idem. Ueber Ostitis fibrosa. Berl. Gesellsch. f. path. Anat. u. vergl. Path. Klin. Wchnschr., 1923, ii, 1044.
22. Idem. Zur Methodik der anatomichen Untersuchungen bei Ostitis fibrosa. Berl. Gesellsch. f. path. Anat. u. verg. path. Klin. Wchnschr., 1923, ii., 1429.
23. Recklinghausen, F. von. Die fibroese oder deformierende Ostitis, die Osteomalazie und die osteoplastische Karzinose u.s.w. Festschrift der Assitenten f. Virchow, Berlin, 1891.
24. Idem. Untersuchungen ueber die Rachitis und Osteomalazie. Jena: 1910.
25. Rehn, E., Die Schnueffelkrankheit des Schweines, u.s.w. Beitr. z. path. Anat. u. z. allg. Path., 1908, xliv, 274.
26. Richter, P. F., and Pick, L. Demonstration eines Patienten mit syphilitischer deformierender ostitis. Berl. med. Ges., 1923, June 6. Med. Klin., 1923, xix, 884.
27. Silcock, Q. Path. Soc. London, Lancet, 1885, i, 519.
28. Skillern, P. G. Syphilis in the etiology of fibrous osteitis. Am. J. M. Sc., 1913, cxlvi, 531.
29. Stadler, E. Ueber Knochenerkrankung bei Lues hereditaria tarda. Fortschr. a.d. Geb. d. Roentgenstr., 1907, xi, 82.
30. Stenholm, T. Path-Anat. Studien ueber die Osteodystrophia fibrosa. Upsala, 1924.
31. Werther. Ueber Ostitis deformans in folge von Syphilis hereditaria. Deutsche med. Wchnschr., 1891, xxv.
32. Wieting, J. Zur Sabelscheidenform der Tibia bei Syphilis hereditaria tarda. Beitr. z. klin. Chir., 1901, xxx, 615.

PERITONITIS OSSIFICANS

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CALCIFICATION of soft tissue is fairly common, while ossification, apart from the formation of the normal skeleton, is much less frequent. It is desired in this note to report an ossification, apparently analogous to myositis ossificans, deserving the nomenclature of "peritonitis ossificans." A fairly careful search of the literature has been made without finding a similar case. The findings herein reported have also been reviewed with Dr. A. E. Hertzler, whose work on "The Peritoneum" is widely known. He states that in over 10,000 titles on the peritoneum, he has not found mention of anything of this character.

The mass, measuring 4 by 9 by 12 millimeters, was found about the tip of an atrophic appendix. It was surrounded by omentum, which closely adhered to the mass in all its non-appendiceal attachments. The portion attached to the appendix was so firmly fixed that the peritoneal coat was stripped off in delivering the mass.

The mass and the appendix were submitted to Dr. H. R. Wahl, pathologist of the University of Kansas School of Medicine, who has given the following report (in part) and made the accompanying photomicrograph from the sectioned mass.

Gross pathology. "There are two pieces of tissue, one is a rather hard stone-like tissue. It is apparently a calcified mass, or a bony mass. It is irregular on its outer surface.

"The other piece of tissue consists of an appendix. . . . Its outer surface is consistently roughened. It feels indurated. The wall is thickened. The lumen is almost obliterated. . . . At one point at the distal end, a part of the serosa and muscularis is torn off."

Histological pathology. "A section through the bony or calcified mass shows irregular, atypical bone formation, with irregular areas of calcareous material at one side. Between the lacunæ and spaces of the bone trabeculæ there is loose connective tissue; irregular lacunæ may be seen throughout the bony trabeculæ."

Section of appendix. ". . . The pictures suggest areas of subacute inflammatory reaction, situated mostly around the appendix rather than within it. There is nothing to suggest a specific process."

Diagnosis. "Chronic obliterative appendicitis, with subacute peri-appendicitis.

Bone metaplasia. "Apparently this represents a bony change in a mass of old chronic inflammatory tissue surrounding the appendix, a remnant of this inflammation being recognizable on the surface of the appendix."

The following notations from the patient's history are of interest:

Mrs. G. B. G., age 35 years, stated that she had had a right pelvic abscess 16 years before operation. She was quite well until 2 weeks ago. Examination showed urine negative; white blood corpuscles,

Fig. 1. An X-ray picture of the bony mass.

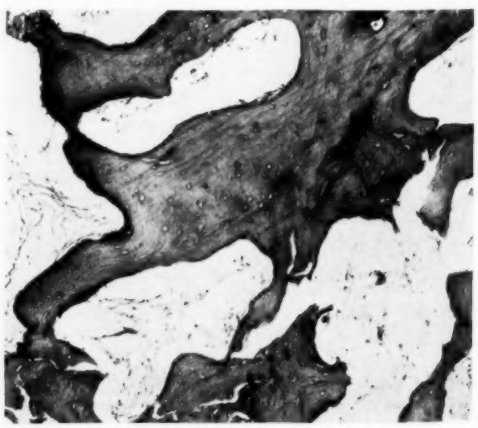

Fig. 2. A photomicrograph made from the bony mass.

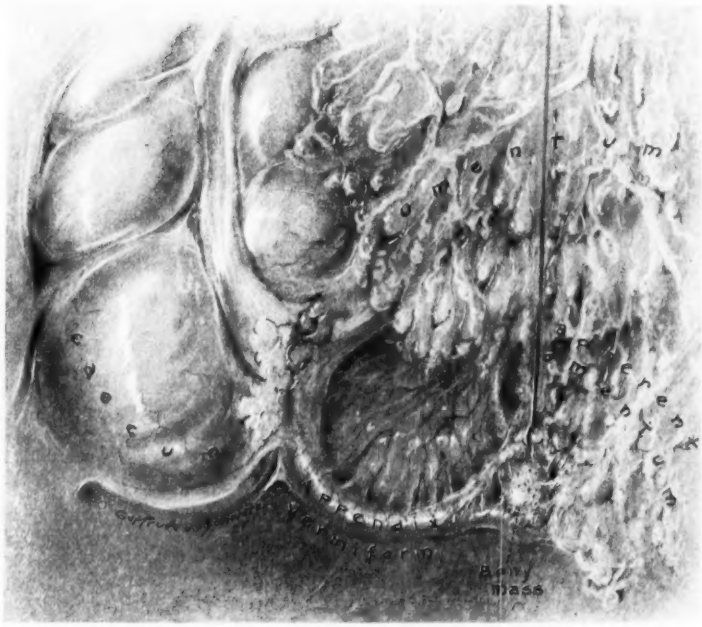

Fig. 3. A drawing locating the mass as it was found at operation.

15,800; polymorphonuclears, 86 per cent; pulse, 86; temperature, 99 degrees F.; Wassermann, four plus. Vaginal examination showed a tender mass in the region of the right adnexa about 6 centimeters in diameter.

At operation, May 2, 1924, at St. Mary's Hospital, the writer performed a bilateral salpingectomy and appendectomy.

After the operation the writer recorded on the patient's gross pathology record: "The appendix was atrophic, adherent to the omentum, had a thick short meso-appendix, and adherent to the serosa of its tip was a deposit, apparently calcareous, about the size of an ordinary white bean. Adherent to this mass also were folds of omentum."

It appears that this specimen is unique enough to merit being recorded among the rare forms of ossification.

The writer invites discussion of the opinion and findings of others which may bear on this subject. Since finding this specimen, I have learned of two peri-appendiceal calcifications, without ossification, in the practice of other surgeons.

FATTY TUMORS OF THE UTERUS

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CASE reports of uterine tumors characterized by varying amounts of fat tissue are rare. Schleussner (5) in 1921 reviewed the literature and at the same time reported a case of lipoma of the uterus. In his paper he gave a brief review of the cases reported prior to 1921 and cited Seydl's paper for a review of the cases prior to 1903. Including his own case he could find reported only 17 cases of undoubted fatty tumors of the uterus. Of these tumors, 7 including his own were listed as simple lipomata. The other tumors were classed as lipomyomata. Four occurred as cervical polyps, the remaining 13 as tumors of the body of the uterus. About the same time Andrews (1) reported a case of a uterine tumor in which fat tissue was found. He listed his tumor under the heading of lipomatosis of the stroma of a uterine fibromyoma.

In view of the rarity of these tumors it would seem worth while to report a case of a fatty tumor of the uterus that occurred on the surgical service of Dr. P. B. McLaughlin.

Mrs. B., age 64 years, was admitted to the hospital September 22, 1924, complaining of frequent urination and a dragging sensation in the pelvis. She stated that she had suffered this pelvic distress from time to time for the past 30 years. There was no history of uterine bleeding. Menstruation began at the age of 11 years, had been regular, and of the twenty-eight day type. The menopause occurred at 50 years of age. She had had 3 normal pregnancies, and 2 miscarriages. The patient was moderately well nourished. Examination revealed a large cystocele with the cervix at the introitus of the vagina. The uterus was very large and was tipped back into the hollow of the sacrum. A diagnosis of fibroma of the uterus was made, and a total hysterectomy together with a repair of the cystocele was done under local anæsthesia by Doctor P. B. McLaughlin, September 23, 1924. Recovery was uneventful.

Gross findings. The uterus and tumor measured 8½ by 11 centimeters. The perimetrium was perfectly smooth. The cervix was attached and stretched out 8 centimeters long. The tumor was sectioned and was found to be of the intramural type. It occupied all of the posterior and right lateral wall of the uterus. The uterine cavity was pushed to the left and was markedly distorted by the tumor mass. The entire tumor was covered with about 5 millimeters of uterine muscle tissue. The endometrium was smooth, somewhat hæmorrhagic and rested upon about 2 millimeters of muscle fibers. Sections of the tumor presented a very lobulated structure; in fact the lobules could be easily separated with blunt dissection and peeled out with ease. The lobules varied in size from that of a cherry to the size of a hen's egg and were very irregular in shape. Some of the lobules were white and firm and had the appearance of an ordinary lobulated fibroma; while others were soft and œdematous. One lobule especially was dark yellow, soft and appeared like a large lobule of fat. The cut surface protruded above the surface of the other lobules. On closer inspection one could note small yellowish areas scattered through all the lobules. The lobules were separated with a small amount of loose connective tissue, carrying many blood vessels. These vessels would run great distances in the tissue before they would finally turn abruptly and disappear in the substance of one of the lobules.

Microscopic examination. Sections stained with hæmatoxylin and eosin taken from various parts of the tumor showed it to be made up of true fat tissue, fibrous and smooth muscle tissue. The fat cells were large with the usual flattened nucleus pushed to one side giving the cell the typical signet ring appearance. In the larger areas the fat cells were closely packed and were polyhedral in shape. Bands of connective tissue passed through the larger areas of fat and occasionally small islands of smooth muscle cells were noted. Sections from the more fibrous areas showed many fat cells scattered throughout, either in small groups or singly. Van Gieson's stain showed a large amount of connective tissue containing varying amounts of smooth muscle fibers. The coarser collagen fibers could be easily made out and the smooth muscle fibers could be readily differentiated from the connective tissue. Some areas showed beginning hydropic degeneration of the connective tissue, while others showed marked hyaline change. The fat stained readily with fat stains. Frozen sections were made and stained with Sudan III. The fat globules stained bright red and in each large globule many fatty acid crystals could be seen.

DISCUSSION AND CONCLUSION

The histogenesis of fatty tumors of the uterus has been variously interpreted by different authors. This has led to con-

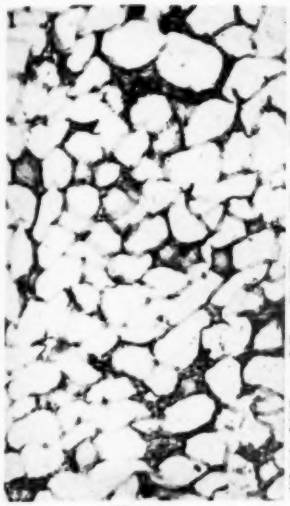

Fig. 1.

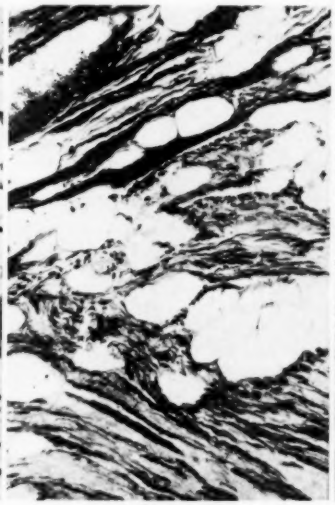

Fig. 2.

Fig. 3.

Fig. 1. Fatty portion of tumor, low power.
Fig. 2. Low power view of section from the more fibrous portion of tumor.

Fig. 3. Low power view of osmic acid preparation showing the distribution of the fat cells in the more fibrous portion.

siderable confusion and as a result these tumors have been variously named, as, lipomata, lipomyomata, fatty tumors of the uterus, and lipomatosis of the stroma of a uterine fibromyoma. The more recent authors who have discussed the histogenesis of these tumors seem to think that the bulk of the evidence in their case was on the side of the lipoblastic displacement theory advanced by Seydl. Cohnheim's embryonic cell rest theory has also been advanced. Others have thought that the fat came from the ingrowth of true fat tissue along the blood vessels and nerves. Lastly the muscles and connective tissue cells were thought to have taken up fat in the globular form, thus becoming true fat tissue.

With the hope of throwing some light on the origin of the fat in these tumors, a careful search was made of sections from numerous blocks taken from various portions of the tumor, for the presence of fat droplets in the connective tissue or muscle cells. Frozen sections were first used and stained with Sudan III. The fat stained a bright red and could be easily detected. All sections showed so many small globules and droplets of fat dispersed by the microtome knife over the surface of the sections and even down between the tissue fibers, that it was impossible to differentiate between the globules and droplets so dispersed and those deposited during growth of the tumor. In order to overcome this difficulty, blocks of tissue 1 centimeter square and 5 millimeters thick were cut from the more fibrous areas of the tumor and washed several days in distilled water. The blocks were then placed in 1 per cent osmic acid for 8 days in the incubator at 37.5 degrees C. The blocks were next washed several days in 70 per cent alcohol and dehydrated, cleared in choloroform, and finally run into paraffin blocks.

Sections from these blocks showed the fat to be stained jet black and not dispersed in small globules over the surface of the sections as in the case of the frozen sections. Fat cells were found in all sections. They occurred usually in the bands of connective tissue, but frequently fat cells were found in close proximity to bands of smooth muscle fibers.

Closer study revealed, occasionally, cells containing small droplets of fat stained black with osmic acid. The droplets varied in size

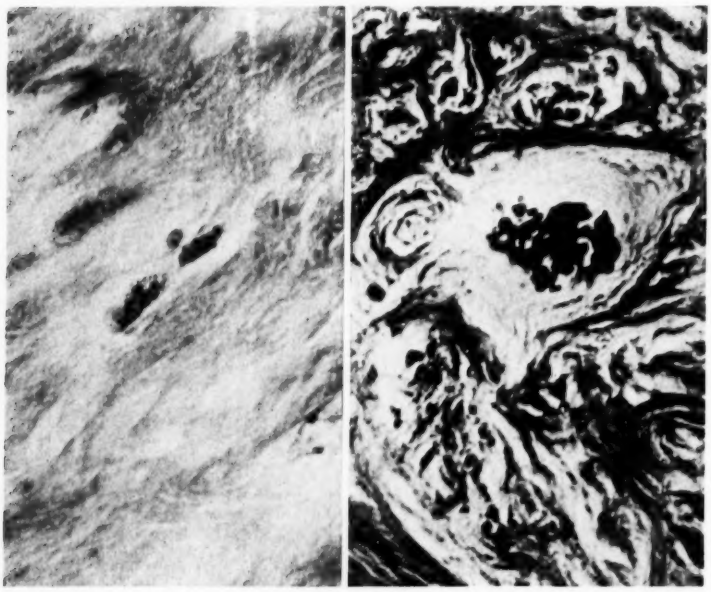

Fig. 4 (left). High power view (oil immersion) of osmic acid preparation showing two cells containing small fat droplets.

Fig. 5. High power view of osmic acid preparation showing a collection of fat globules. The globules are surrounded by an area of fine fibrillar connective tissue. The globules were not all in the same plane so that their shadows were more or less superimposed and the large irregular areas of fat in the photomicrograph were thus produced.

from small specks to one-fourth the size of a red blood cell. These cells were not numerous and were only occasionally noted. They occurred in bands of connective tissue closely packed between the collagen fibers. They were somewhat larger than ordinary connective tissue cells. Some of the cells were spindle shaped while others were stellate and irregular in shape. In some areas they appeared much as young fibroblasts with long protoplasmic processes connecting one with the other. The nucleus was large, centrally located, and was very granular. The fat droplets when present occurred either in small collections at one or both poles of the nucleus or they were distributed in the cytoplasm in the immediate vicinity of the nucleus. Attempts to demonstrate fibroglia fibrils in connection with these cells failed. These cells were never found in bundles of smooth muscle fibers. Again a number of other areas were found in which collections of small globules were noted. Sometimes there would be one larger globule with 4 or 5 smaller surrounding globules; other areas would show a collection of 7 to 12 distinct small globules. These collections of globules were usually surrounded with an area of fine fibrillar connective tissue as shown in the photomicrograph (Fig. 5). Careful study under high power showed these droplets and globules to be distinctly inside tissue cells and not collected upon the tissue cell as an artifact. The photomicrographs I think will show this. However the number of distinct droplets and globules and their position cannot be appreciated fully except by focusing with the microscope and noting the different levels. Single fat globules were not taken into consideration as it was not possible to differentiate such single globules from portions of large fat cells cut near one pole.

Since these developing fat cells occurred always in the presence of connective tissue,

and since fat droplets could not be found in cells which could be proven definitely to be smooth muscle cells I feel that one is justified in placing these cells in the connective tissue group. They then must represent either the type of connective tissue cell commonly found in the uterus and tumors of the uterus, or they represent some specially differentiated type of lipogenic connective tissue cell. Therefore, the fat tissue must be derived from either of these two groups. According to Bailey and Miller (3) fat tissue develops from embryonic connective tissue cells. The fat replaces to a great extent the cytoplasm in many of these embryonic cells. These cells first appear in the axilla and groin of the fetus about the thirteenth week. Fat is formed in other places at later periods and even during adult life, but the mode of development is always the same. The whole question as to the origin of these fat cells depends upon whether fat cells develop from any embryonic connective tissue cells or whether they develop from specially differentiated embryonic connective tissue cells. According to Bailey (2) this question has not been definitely settled.

It would seem that the fat tissue in these tumors must arise from some specially differentiated connective tissue cells. If fat could develop from the connective tissue commonly found in uterine tumors one would expect to find more tumors of the uterus containing fat tissue. But from the literature it is evident how infrequently fat tissue is found in tumors of the uterus. Even fatty degeneration is rare. As pointed out by Elkin and Haythorn (4) in their paper quoting McDonald, only 7 cases out of 530 reported by various authors showed even this change. Furthermore fat tissue is never found normally in the uterus, tubes, and ovaries.

Since congenital remains and displacements frequently occur in the female genital tract one must necessarily consider the possibility of these fat tumors developing from lipogenic displacements. These embryonic cells may remain in the uterus and in later life take part in producing the fat in these tumors. For a general discussion of the various theories as to the histogenesis of these fatty tumors of the uterus, I refer the reader to the papers of Schleussner, and Elkin and Haythorn, and to the bibliography there given.

This case shows that developing fat cells may be found in fatty tumors of the uterus. These fat cells develop from connective tissue cells which probably represent a specially differentiated type of connective tissue cell.

At this time I wish to express my indebtedness to Doctor P. B. McLaughlin, of St. Joseph's Mercy Hospital, for the privilege of reporting this case.

REFERENCES

1. Andrews. Proc. Roy. Soc. Med., London, 1920–1921, xiv, Sec. Obst. & Gynæc., 305.
2. Bailey. Textbook of Histology. 6th ed., p. 92a.
3. Bailey and Miller. Textbook of Embryology, 2d ed., p. 171.
4. Elkin and Haythorn. Surg., Gynec. & Obst., 1917, xxv, 72.
5. Schleussner. Proc. New York Path. Soc., 1921, xxl, 33.

A STUDY OF THE INTRAMURAL PORTION OF NORMAL AND DISEASED TUBES WITH SPECIAL REFERENCE TO THE QUESTION OF STERILITY[1]

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IN the many careful descriptions of the normal anatomy and histology of the fallopian tubes, most of the attention has been centered on the free intra-abdominal portion.

Recently Hermstein and Neustadt (2) published the results of their studies of the intramural portion of the fallopian tubes in 15 normal cases. They found that, contrary to the usually accepted belief, the intramural portion of the tube did not run a direct course from the uterine ostium through the uterine wall, but that there were two distinct ways in which it traversed the uterus. In one, the tube took a more or less direct course, and in the other it was a convoluted or angular one. The frequency of the two types was about equal. They found that both tubes, in each instance, conformed to the same type, i.e., when one side was direct the other was also direct.

They also found that the uterine ostium was not a definite fixed point, but that the uterine cavity was drawn out into a funnel, at the apex of which the tube begins. In two instances there was a direct differentiation, sharp and well defined, between the gland bearing uterine mucosa with its cytogenous stroma, and the single layered epithelium with scanty stroma of the tubal mucosa. In most instances, however, there was a so-called transitional zone where the mucous membrane of the uterus showed few or no glands, the stroma was entirely absent, there was a scanty tunica propria, and the tubal epithelium presented no villi.

The tube proper, which can be recognized by the typical well-developed musculature, stands out very prominently. The outer circular muscularis is poorly developed. The mucosa shows typical high cuboidal, ciliated epithelium, with no distinct villi, but suggestions of folds. These folds occasionally become a little more prominent as the isthmus is approached.

Kuestner (4) denied the occurrence of villi in the intramural portion of the tube while Grusdew (1) and Troellen (6) described typical folds.

Hermstein and Neustadt point out the difficulty, even the impossibility of probing or distending, except by intratubal growths, this intramural portion. The lumen is only 0.5 to 1 millimeter and the entire course is surrounded by a dense unyielding uterine musculature.

Our studies on the intramural portion of normal and diseased tubes were carried out on extirpated organs. These were obtained by operation, and included the uterus and adnexa. The specimens were prepared by

Fig. 1. Normal tubal course showing gentle direct curve through cornu of uterus with slight angulation. Note distention of distal portion.

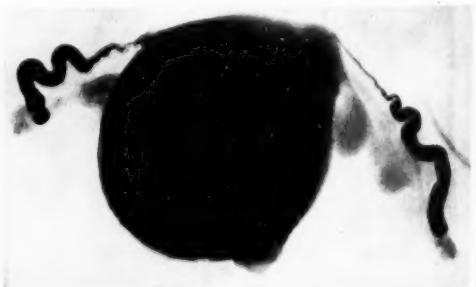


Fig. 1a. Normal course in fibroid uterus showing elongation of intramural portion with sharp rise from uterine funnel. Angulation on one side. Again note non-distensibility of isthmus, intramural portion and slight encroachment of uterine cavity by fibroid.

[1] Read before the American Gynecological Society, Washington, May 4, 1925.

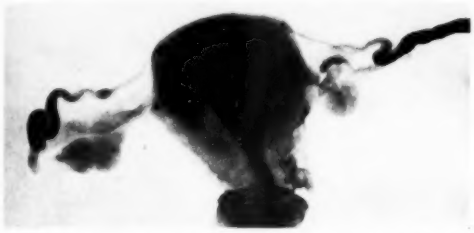


Fig. 2. Normal course showing sharp angulation on one side and tortuous course on the other.

tying the tubes, when they appeared grossly patent at the fimbriated extremities, insufflating, and later by means of a piston syringe injecting the uterus and tubes with a 20 per cent sodium iodide solution. The cervix was then tied to prevent the escape of the fluid and an X-ray photograph taken of the organs. When the tubes were closed by adhesions, no ligature was necessary. The amount of pressure necessary to inject the diseased tubes was often considerable. In some instances the fluid, in spite of tremendous pressure, could not be forced into the tubes. After the X-ray photograph was taken the uterine horn and the intramural portion of the tubes were removed and fixed. Blocks were cut, approximately 0.5 centimeter in thickness, and embedded. These were cut as interrupted serials, that is, every fifth to eighth section of 15 microns was saved, stained, and mounted. In some instances no injection was done, just serial sections cut, with these as controls, to rule out any possible error due to the effect of the iodide solution on the epithelium or tubal

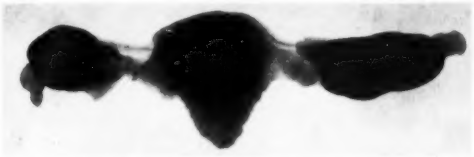


Fig. 3. Normal course showing direct curve of exit on one side and L-shaped course on the other.

lumen. It can be readily understood that, in some instances because of the pressure exerted in injecting the tubes, a partial passage of fluid was made, where under normal circumstances the lumen would not be traversable.

Rubin (5) reported a few cases in which he had injected 10 per cent collargol to determine the patency of the tubes. This was done on the living patient and X-ray photographs were taken. The results were apparently not satisfactory for nothing else was published along these lines until his valuable method of gas insufflation was described.

Kennedy (3) published a series of 18 cases in which he injected the tubes and uterus with a solution of sodium bromide and took X-ray photographs. This also was done on living patients. In addition insufflation was done in these cases. In 1 the tubes were partly occluded, in 17 absolutely occluded. In 3 cases of occlusion no shadow was obtained, in 1 in which the tubes were partly occluded there was also no shadow, that is, the bromide solution passed into the abdomen. Of 26 other tubes showing a negative insufflation test, 8

Fig. 4. Showing bizarre form of intramural course. A complete loop on one side, gentle curve on the other.

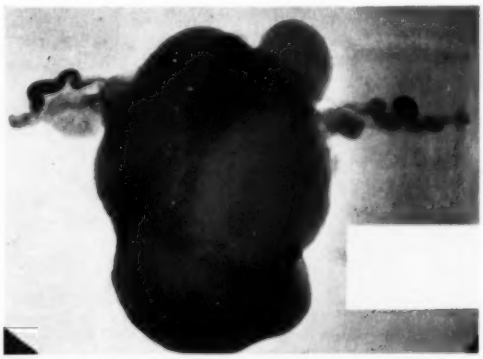


Fig. 5. Normal course in a fibroid uterus showing convoluted type on one side, sharply angular on the other.

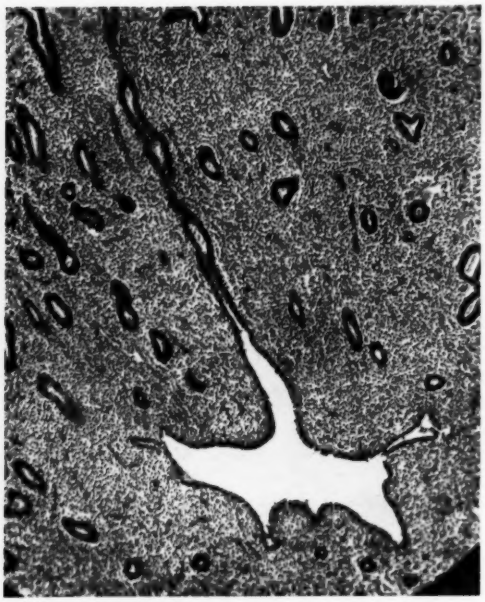


Fig. 6. Mucosa of the funnel. Typical uterine mucosa.

showed no tubal shadows, that is, there was an obstruction in the cornu or isthmus, and 18 showed obstruction only at the fimbriæ.

This is a most important step in conjunction with the insufflation tests, if an accurate method is to be devised to relieve the condition of sterility due to occlusion of the tubes.

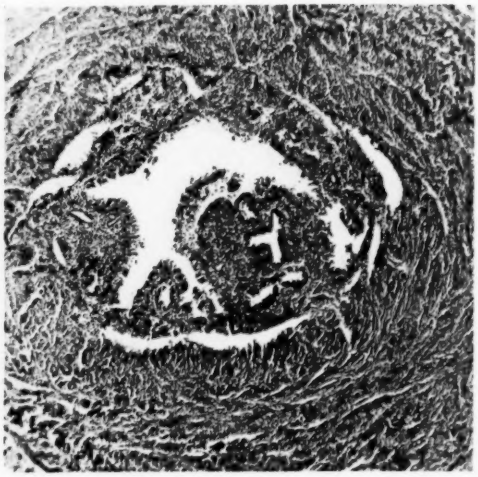


Fig. 7. Transitional mucosa. Few uterine glands and scanty stroma with beginning large spaces lined with high cylindrical epithelium.

Our studies were undertaken to determine the type of lesion that causes the obstruction, as well as the site of the obstruction.

We can substantiate the findings of Hermstein that the intramural portion of the tube presents a varied course through the uterine musculature. The uterine cavity expands in

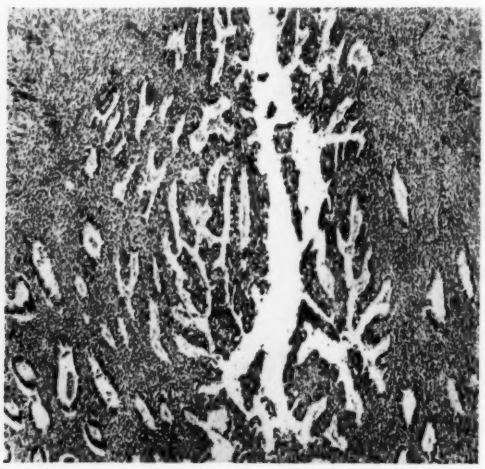


Fig. 8. Transitional mucosa, uterine type of glands on one side beginning large communicating glands on the other lined by high cylindrical epithelium.

Fig. 9. Showing the intramural portion of the tube, the contour being shaped like a cross. Note thick longitudinal muscle band.

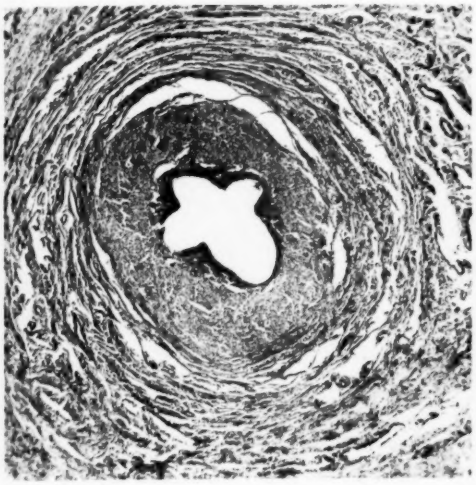


Fig. 10. Intramural portion. Clover leaf type. Note muscle layer.

Fig. 11. Intramural portion. H-shaped. Note muscle layer.

its upper portion into a cone-shaped extension on either side. This gradually narrows down and its apex is continuous with the tubal lumen. From this point the tube presents many variations. Its caliber varies from 0.5 to 1 millimeter and its length from 1.5 to 5 centimeters. In about 40 per cent of the cases it passes in a gentle direct curve with the convexity upward through the wall of the uterus until it emerges (Fig. 1). Occasionally it rises in a steep curve more or less abruptly from the uterine funnel (Fig. 1a).

In the remaining cases the course is not a simple direct one, but tortuous, either traversing the uterine wall in a series of gentle convolutions up to 4 in number, or in a course marked by decided angulations either 1 or 2 in number (Fig. 2). In the angular course, the tube usually rises sharply from the uterine cone to within a few millimeters of the peri-

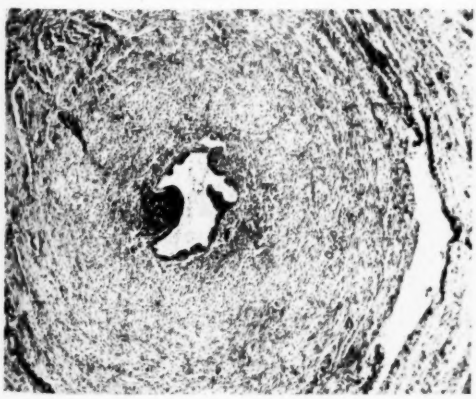


Fig. 12. Intramural portion of the tube showing an inflammatory foci located beneath the mucosa and in the muscularis.

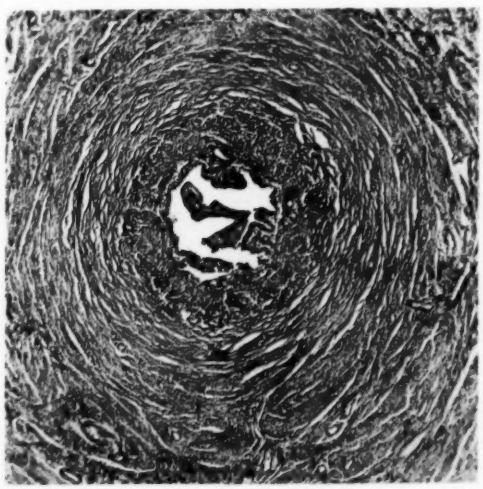


Fig. 13. Intramural portion just before isthmus is reached. Swelling and infiltration with round cells. Some epithelial desquamation and adhesions.

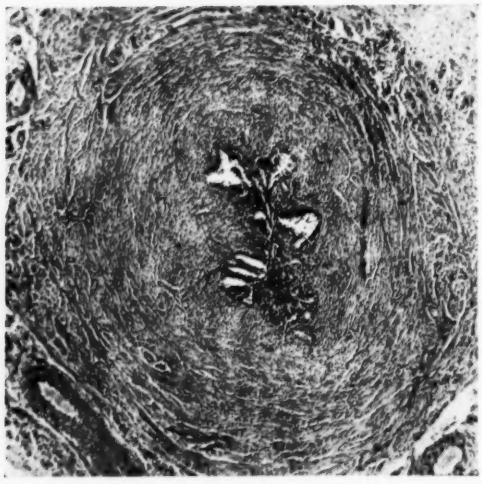


Fig. 14. Intramural portion near isthmus showing formation of pseudo glands and adhesions of epithelial surface completely occluding the lumen.

toneal surface, then sharply bends down again until it emerges. Occasionally just before, or at, its point of departure from the uterus it again makes a sharp angle giving it an L-shaped point of exit (Fig. 3a) or other bizarre forms (Fig. 4). The tubes may be symmetrical in type but often one side may present the gradual simple curve while the other may show the convoluted or angular type (Figs. 1, 2, 3, 4, and 5).

The gradation from the uterine to the tubal mucosa is, as a rule, a slow transition as has been described by Hermstein, though occasionally, we also have found an abrupt differentiation. The upper end or narrow portion of the uterine funnel presents the typical uterine epithelium (Fig. 6). This gradually fades out into a mucosa, where the glands are fewer in number, more irregular in outline, and more closely grouped, as if preparing to fuse to form the tubal lumen. They have a more feathery appearance and the cells themselves become high, slender, and cylindrical in type. The stroma is less cellular and the tunica propria is scanty. This can be termed the transitional zone (Figs. 7 and 8). From this point there is a rapid change, with loss of all glands, disappearance of the cytogenous stroma, and the beginning of the well-developed mass of longitudinal musculature under the tubal epithelium.

The tube can be definitely recognized not only by the change in the mucosal type but also by the well marked and rapid development of the longitudinal muscular coat situated just below the mucosa.

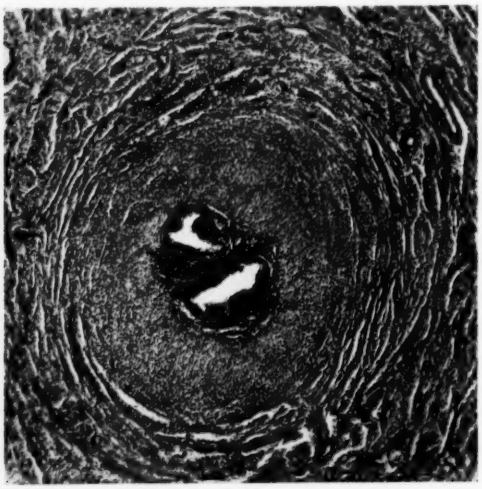


Fig. 15. Intramural portion showing result of adhesions, round cell infiltration with destruction of a continuous lumen and formation of two canals.

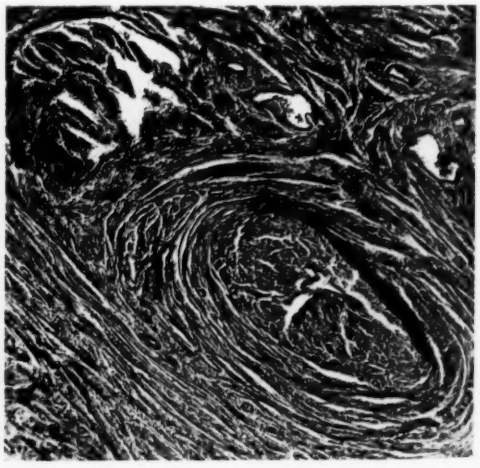


Fig. 15a. Intramural portion showing adhesions of surface and destruction of a continuous lumen with formation of two canals.

The normal tubal mucosa in the intramural portion does not present definite villi. It shows a varying grade of low, simple protuberances from 1 to 3 in number. One may get many varieties of lumina, but all widely patent. The contour may be oval, or clover leaf, may be shaped like the letter H, or like a cross. The villi, if one wishes to call them so, are simple and broad, not occlusive (Figs. 9, 10, and 11). Occasionally there is just a slit-like lumen without elevations.

The detailed histology has been already accurately described by many authors.

The musculature already mentioned stands out as a very distinct layer (Figs. 9, 10, and 11).

It enables one to pick out grossly the tube from the vessels in the cross section of the uterine horn. The bundles are heavy, run parallel to the course of the tube, and are accompanied by broad bands of fibrous tissue. The layer of muscle diminishes rapidly in thickness as the free intra-abdominal portion of the tube is approached to lose itself in the circular musculature. In the true intramural portion, the outer circular layer is thin and narrow and lies completely surrounded by the uterine muscularis for some distance, and only near the point of emergence does this layer present itself, poorly developed but definite. It is this situation in the unyielding uterine musculature, in combination with its varied course, that makes the probing of the tube from the abdominal side impossible.

A strange fact that we have as yet not entirely explained is the lack of distensibility of not only the intramural portion of the tube but the first 2 centimeters of the free portion. We believe that it is due to the firmness and rigidity imparted not only by the uterine muscu-

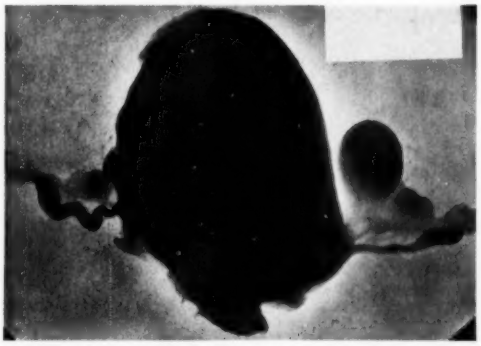


Fig. 18. Fibroid uterus showing encroachment on tubal cornu on left side with marked angulation and convolution, but not complete occlusion.

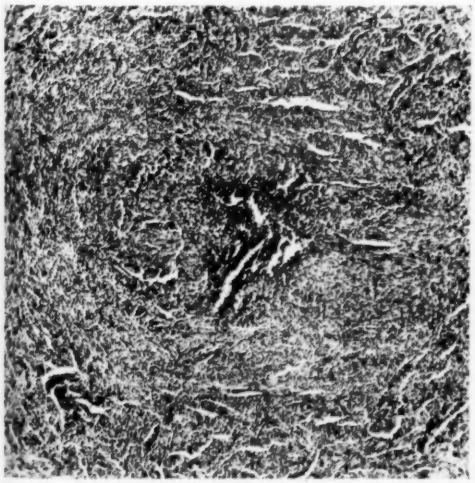


Fig. 16. Complete obliteration of lumen with destruction of epithelium. Spaces are artefacts.

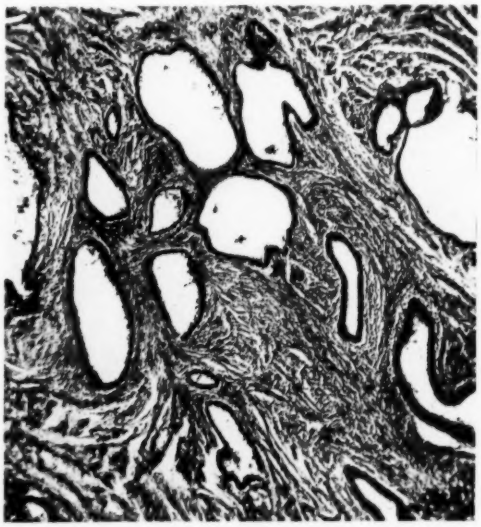


Fig. 17. Adenomyomatosis of uterine cornu involving the tubal wall. No definite tubal lumen found.

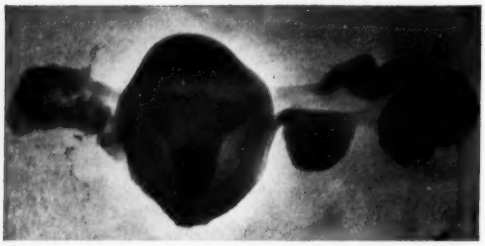


Fig. 19. Diseased tubes with closed fimbriæ. Solution does not pass into tube, arrested in cornu. The density on the right side due to pus in tube. Incision into tube after injection showed no iodide solution in the sac.

laris but also by the well-developed longitudinal muscular band.

The conditions found in the intramural portion of chronically diseased tubes are most varied. We took cultures from all the tubes to determine if any organisms still persisted, and found, that in the tubes studied, the cultures showed no growth. In other words the lesions represented the end-results of the inflammatory process. The tubes grossly showed closed, clubbed, fimbriated extremities, or occasionally patent fimbriæ with peritubal adhesions or distortion. In this way the retort-shaped hydrosalpinx or pyosalpinx was accounted for. Of course for the purpose of this investigation the pyosalpinges or tubo-ovarian abscess played no great rôle, but they illustrated the frequency of the lesions to be described.

In most of these diseased types, definite pathological lesions were found in the intramural portion of the tube. We found frequently a definite œdema of the mucosa with an infiltration of round cells and increased vascularity, resulting in sufficient swelling and thickening of the mucosa to cause some obstruction (Figs. 12 and 13). Again one finds adhesions between the small protuberances, forming numerous small lumina, some ending blindly and forming pseudo glands, showing often the same inflammatory changes described above (Fig. 14). In some instances the desquamation of the epithelium leads to the healing together of adjacent surfaces, dividing the lumen into two canals (Figs. 15 and 15a), or even may be so extensive as to completely close it with a scar, or to present only a collection of round cells, where once there had been a definite lumen, not unlike the obliterative process seen in old diseased appendices (Fig. 16).

Fig. 20. Diseased tubes. Right has closed fimbriæ. Note collection of iodide solution just beyond intramural portion. Occluded beyond. Left side fimbriated end patent but solution arrested by an occlusive lesion in intramural portion.

Another interesting and rather common finding in these old inflammatory cases was

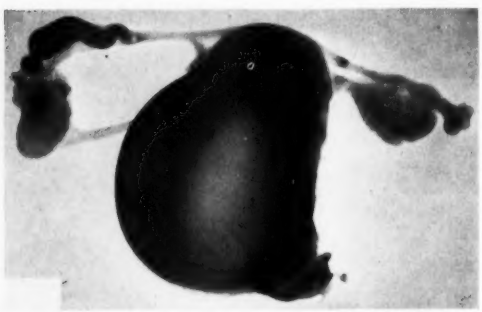


Fig. 21. Tubes with patent fimbriated extremities in a fibroid uterus. On one side occlusive lesion just beyond intramural portion. Pressure forces fluid in for short distance. On other side distal portion distended.

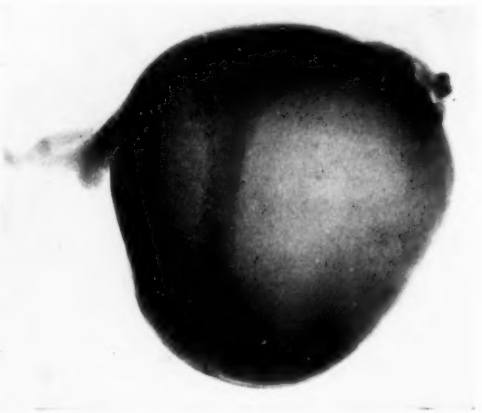


Fig. 22. Fibroid uterus. In this case there are normal tubes, but the right intramural portion does not permit the passage of fluid because of the presence of the fibroid.

the presence of a definite adenomatosis of the uterine cornu. In the uterine horn the glandular proliferations could be traced directly to the uterine mucosa. This adenomatous condition often extended alongside the intramural portion of the tube occluding it somewhat. We could not trace these glandular elements to the tubal lumen (Fig. 17). This type of lesion, when it involves the tube proper, has been termed "salpingitis isthmica nodosa."

In passing it may be noted, that in some instances in non-inflammatory cases, we found a definite obstruction to the tube of neoplastic nature, at its intramural portion. In some instances cornual polyps and in 2 cases small fibroid nodules 1 centimeter in diameter were so situated in the horn as to occlude completely the tubal lumen (Figs. 18 and 22).

The X-ray photographs of the iodide injected organs in the diseased cases are most instructive. It can be seen how in many instances the iodide solution fails to pass the uterine cornu (Fig. 19). Again one can see it extend inward a short distance and collect in a small mass at the interstitial portion of the tube; possibly because the solution accumulates in the dilated blind pseudo glands formed by the adhesions of the tubal surface, or in the glandular structures of the cornual adenomyomatosis (Fig. 20). Occasionally it passes the obstructive points to accumulate in small amounts between these points (Fig. 21). It is possible that the great amount of pressure exerted may have forced the fluid beyond the obstructing lesions (Fig. 19). Again we found that in tubes with grossly patent fimbriæ and evidences of peritubal inflammation, the iodide solution could not be forced past the uterine horn because of an obstructive lesion, the result possibly of a completed tubal infection (Fig. 20).

Whenever the interstitial portion of the tube permitted the passage of the solution the terminal portion of the tube was distended (Figs. 19 and 21). We were never able to distend the interstitial portion, or the first portion of the isthmus, probably because of the thick intrinsic and extrinsic muscular support of the tube. As was previously mentioned, the interstitial portion of the tube presents, just under the mucosa, a thick band of longitudinal muscle and a thinner interrupted band of circular muscle. As the tube progresses to the free portion, the strong inner longitudinal bundles gradually decrease in thickness and disappear, the circular muscle remains as a thin layer and outside of this, develops a scattered incomplete longitudinal layer. The contractility of this interstitial portion is great, its lumen small, and these facts may explain why it is rarely distended. It explains why, when these fresh organs are injected (still living), the fluid is forced out by the muscular contraction, into the distensible distal portion. It may also explain the shape of the typical pyosalpinx or hydrosalpinx.

When we review the importance of these findings both in the normal and diseased tubes we note that they have a distinct bearing on the question of sterility.

The normal variations in the tubal course may of itself present difficulties for impregnation. Tubes that have a decided convoluted course or exaggerated angulations, depending on the number and sharpness of the angulations may offer a decided obstacle to the spermatozoa in their ascent, or to the ovum in its descent. The interesting question, which we can just mention here, of the greater barrier offered to the impregnated ovum and the subsequent development of a tubal pregnancy, may find at least a possible answer in these variations.

The various types of intramural lesions, either inflammatory or neoplastic, that have been mentioned, offer too, an almost insurmountable barrier for spermatozoa and ova, even if the lesions are not absolutely obstructive.

In view of the frequency of diseased conditions in the intramural portion that may offer a decided bar to the ascent of the spermatozoa or the descent of the ovum, it is essential to determine the site of all obstructions in diseased tubes. The important thing is to determine if the obstruction is only at the fimbriated extremity, at the intramural portion, or at both places. Probing the tube (whose caliber is from 0.5 to 1 millimeter) is practically impossible, as can readily be understood by visualizing the course, tortuous and fixed in the uterine horn.

The most reasonable method is that suggested by Kennedy, and with a perfection of technique it should prove of inestimable value.

It is obviously useless to attempt a plastic operation on the fimbriated extremity, with an occlusive lesion in some other portion of the tube.

The interpretation of the insufflation test must be somewhat changed in the light of these findings. The variations of the normal intramural tubal course, with its convolutions and sharp kinking so frequently seen, may account for the marked variations in pressure required to obtain a positive test. A high pressure may not mean an abnormal intratubal obstruction, simply an obstruction due to the angular tubal course. A sharply kinked intra-uterine course, with a contracting uterine muscle, may give a negative test and at some subsequent time, when the uterus is relaxed, the test will be positive. It too may happen, that in a patient with a negative test, a laparotomy will demonstrate a patent fimbriated extremity and a test done with the abdomen open will be positive. This too may be due to the relaxation of the uterine contraction and a partial straightening of the intramural course. So we see that we may get either a positive or a negative test in normal tubes. It is essential to determine the cause of the negative test to obviate, if possible, the performance of an unnecessary laparotomy. A positive test under pressure in a normal tube means that the tube is patent for gas, yet the spermatozoön making headway against the current caused by the action of the cilia, must also surmount the obstacles of the kinks and angles that may be present. Likewise the ovum in its descent must be swept over these obstructing ridges in a portion of the tube that is rather rigidly fixed.

So too in a diseased tube one may get a positive or a negative test. Here it must again be emphasized, that a positive test means patency under pressure for gas, and not necessarily for spermatozoa or ova.

One may get a negative test in diseased tubes with patent abdominal ostia and an obstructive lesion in the intramural portion of the tube. A negative test is also obtained in cases with an occluded fimbriated extremity with or without an occlusive lesion in the intramural portion.

It can readily be seen that operative interference which is designed to make patent the abdominal portion of the fallopian tube will prove valueless, if an intramural lesion is present.

Still one more factor that must be considered and investigated is the persistence of the inflammatory process. An attempt at conservative plastic surgery if the inflammatory lesion has not completely subsided, even when the process seems limited to the fimbriated extremity, may result in occlusive lesions in the tube that will vitiate any operative correction of the lesion at the abdominal end.

CONCLUSIONS

1. Variations in the course of the intramural portion of normal tubes may offer a bar to impregnation.
2. Intramural lesions may make the passage of sperma or ova impossible.
3. Intramural lesions may be present with or without closure of the fimbriated extremity.
4. One may get a positive or negative insufflation test in normal tubes.
5. One may get a positive or negative insufflation test in diseased tubes.
6. A positive insufflation test means that tubes are patent to gas under pressure, not necessarily to spermatozoa or ova.
7. It is essential to locate the occlusion in a case with a negative test if any reasonable hope of assistance from operative procedure is to be entertained.

REFERENCES

1. Grusdew. Zentralbl. f. Gynaek., 1897.
2. Hermstein and Neustadt. Ztschr. f. Geburtsh. u. Gynaek., lxxviii.
3. Kennedy. Am. J. Obst. & Gynec., 1923, vi, 131.
4. Kuestner. Lehrbuch der Gynaek., 1915.
5. Rubin. Surg., Gynec. & Obst., 1915, xx, 2135.
6. Troellen. Monatschr. f. Geburtsh. u. Gynaek., 1917, xlv.

Since submitting this paper for publication two articles of interest in this connection have appeared, one by Kennedy in the J. Am. M. Ass., July 4, 1925, lxxxv, 15-16. In this paper he believes he has demonstrated the contractibility of the isthmus of the tube. The second article is by Schober, read at the meeting of the German Gynecology Society, Zentralbl. f. Gynaek., 1925, No. 30, 1636, in which he advocates the value of salpinography in determining the question of tubal patency.

THE VALUE OF THE LEUCOCYTE COUNT AS AN AID TO DIAGNOSIS IN ECTOPIC GESTATION[1]

By LILIAN K. P. FARRAR, A.B., M.D., F.A.C.S., New York City
From the Clinic of the Woman's Hospital in the State of New York

THE wide variation of the leucocyte count in ectopic gestation even over a comparatively short period of time, had made it seem to me unreliable in diagnosis of that condition until the daily counts which we had made for 6 months on the first division of the Woman's Hospital in postoperative cases revealed to me that the leucocyte count is a constantly changing figure in the days immediately after operation. How rapid this change is was shown by the work two of the students in Cornell Medical College did in their elective course in gynecology at the Woman's Hospital. They took the leucocyte count every hour on a series of patients for the first 24 hours following operation and then daily on the same cases, as I had done before, until the normal leucocyte count was reached. This is reached in the average uncomplicated case on the fifth day. Since the leucocyte count changes so rapidly following operation it seemed to me that possibly it might be that the apparent discrepancies of the leucocyte counts in ectopic gestation are due to the rapid or frequent changes going on in the gestation itself causing the escape of blood into the peritoneal cavity; and with a view to studying a number of these leucocyte counts I collected the case histories of 150 patients who had been operated upon in the Woman's Hospital. In each case the pathologist had diagnosed the specimen as an ectopic gestation.

It is the custom for each patient entering the hospital to have a leucocyte count taken the day of admission and as often thereafter as the attending surgeon deems it necessary.

For study and comparison I have separated the cases into three groups. The first, Group A, includes all the cases that had a leucocyte count below 10,000, the upper limit considered normal in leucocyte counts. The second, Group B, includes all cases with a leucocyte count of from 10,000 up to 16,000. The number 16,000 was taken as the limit of Class B, because a patient with a leucocyte count of more than 16,000 was clinically in a much more acutely ill condition.

Group C includes then all cases having a leucocyte count of from 16,000 or more, and in this series of 150 cases the highest count was 36,350. In every case the last leucocyte count before operation was the one selected. In Groups A and B the last count was made one or two days before operation. In Group C the last count in every case was made on the day of operation.

Leucocytes	Cases	Per cent
Group A. 4,500 to 10,000	72	48
Group B. 10,000 to 16,000	55	36.6
Group C. 16,000 to 36,350	23	15.3
Total	150	99.9

Forty-eight per cent, nearly one-half, of the 150 cases of ectopic gestation had a normal total leucocyte count just before operation.

In 36.6 per cent, more than one-third of the cases, the leucocyte count was increased 10,000 to 16,000 and in 15 per cent it was increased 16,000 to 36,350.

The polymorphonuclear leucocyte count, taken at the same time, and the temperature, pulse, and respiration, taken nearest to the time the leucocyte count was made, were as follows:

GROUP A (4,500 to 10,000)

	Temperature		Per cent
59 cases	98–100		81.9
4 cases	below 98	13	
9 cases	100–100.6		18
72 cases			99.9

	Pulse		Per cent
52 cases	below 100		72.2
15 cases	below 110	20	
5 cases	110–120		27.7
72 cases			99.9

[1]Read before the American Gynecological Society in Washington, May 4, 1925.

GROUP A—(Continued)

	Respiration	Per cent
45 cases	18–20	62.5
27 cases	22–28	37.5
72 cases		100.0

	Polymorphonuclear leucocyte count	Per cent
58 cases	50–75	80.5
14 cases	75–81	19.4
72 cases		99.9

GROUP B (10,000 to 16,000)

	Temperature	Per cent
48 cases	98–100	87.2
1 case	below 98	
6 cases	100–101.4 (7)	12.7
55 cases		99.9

	Pulse	Per cent
40 cases	below 100	72.7
9 cases	below 110	
6 cases	110–124 (15)	27.2
55 cases		99.9

	Respiration	Per cent
34 cases	18–20	61.8
21 cases	22–30	38.1
55 cases		99.9

	Polymorphonuclear leucocyte count	Per cent
27 cases	68–75	49
28 cases	75–90	50.9
55 cases		99.9

GROUP C (16,000 to 36,350)

	Temperature	Per cent
19 cases	98–100	82.6
2 cases	below 98	
2 cases	100–100.8 (4)	17.3
23 cases		99.9

	Pulse	Per cent
10 cases	below 100	43.4
4 cases	below 110	
9 cases	110–138 (13)	56.5
23 cases		99.9

	Respiration	Per cent
9 cases	18–20	39.1
14 cases	22–28	60.8
23 cases		99.9

	Polymorphonuclear leucocyte count	Per cent
0 cases	under 75	
12 cases	77–90	
11 cases	90–96	100
23 cases		100

A comparison of the three groups was then made to see if any decided alteration in temperature, pulse, respiration, or polymorphonuclear leucocyte count could be found, and the percentages are as given in the tables.

COMPARISON OF GROUPS A, B, C

Group A (below 10,000)

	Temperature	Per cent
59 cases	98–100	81.9
13 cases	below 98 or above 100	18
72 cases		99.9

Group B (10,000–16,000)

	Temperature	Per cent
48 cases	98–100	87.2
7 cases	below 98 or above 100	12.7
55 cases		99.9

Group C (16,000–36,350)

	Temperature	Per cent
19 cases	98–100	82.6
2 cases	below 98	
2 cases	100–100.8	17.3
23 cases		99.9

Highest temperature. It is to be noted that in no case of the 150 cases of ectopic gestation did the temperature at any time before operation reach 101.5 degrees F.

Lowest temperature.

Group		Per cent
A	4 cases below 98	5.5
B	1 case below 98	1.8
C	2 cases below 98	8.6

COMPARISON OF GROUPS A, B, C

Group A (below 10,000)

	Pulse	Per cent
52 cases	below 100	72.2
15 cases	below 110	
5 cases	110–120 (20)	27.7
72 cases		99.9

Group B (10,000–16,000)

	Pulse	Per cent
40 cases	below 100	72.7
9 cases	below 110	
6 cases	110–124 (15)	27.2
55 cases		99.9

Group C (16,000–36,350)

	Pulse	Per cent
10 cases	below 100	43.4
4 cases	below 110	
9 cases	110–138 (13)	56.5
23 cases		99.9

In Groups A and B (127 cases) only 11 cases, 8 per cent, had a pulse of 110 or over; in Group C, 9 cases, 39 per cent.

COMPARISON OF GROUPS A, B, C

Group A (below 10,000)

	Respiration	Per cent
45 cases	18–20	62.5
27 cases	22–28	37.5
72 cases		100.0

Group B (10,000 to 16,000)

34 cases	18–20	61.8
21 cases	22–30	38.1
55 cases		99.9

Group C (16,000 to 36,350)

9 cases	18–20	39.1
14 cases	22–28	60.8
23 cases		99.9

In Groups A and B (127 cases), 48 cases or 37 per cent had a respiration of 22 or over but in Group C, 60.8 per cent had a respiration of 22 or over.

COMPARISON OF GROUPS A, B, C

Polymorphonuclear leucocyte count

Group A (below 10,000)

	Per cent	Per cent
58 cases	50–75	80.5
14 cases	75–81	19.4
72 cases		99.9

Group B (10,000 to 16,000)

27 cases	68–75	49.0
28 cases	75–90	50.9
55 cases		99.9

Group C (16,000 to 36,350)

0 case	under 75	
16 cases	77–90 } 23	
7 cases	90–96 }	
		100
23 cases		100

In Group A, only 19.4 per cent were above normal.
In Group B, only 50.9 per cent were above normal.
In Group C, 100 per cent were above normal.

The temperature was not of diagnostic value in this series of cases except that its maximum as noted was 101.4 degrees F.

The pulse was increased to 56.5 per cent in Group C but in only 27 per cent of the cases in Groups A and B was an increase noted.

The respiration in Groups A and B was nearly the same (38 per cent) but rose to 60 per cent in Group C.

The polymorphonuclear leucocyte count was more than doubled in Group B (50 per cent) over Group A and reached 100 per cent in Group C.

The total leucocyte count was increased to above normal in 100 per cent of the cases in both Group B and Group C.

The findings at operation—Group A (below 10,000)
Leucocyte Count

Cases		Per cent
29 Unruptured, no free blood		40.2
2 Partial tubal abortion, fluid blood or clots	43 cases walled in.	
12 Old tubal abortion, fluid blood or clots		
29 Ruptured		59.7
72		99.9

Summary. The findings at operation presented two totally different conditions. In 43 cases rupture or tubal abortion had occurred, the gestation had been ended and the products walled in; but in the other 29 cases no rupture had occurred. However all the cases had one factor in common, that is, there was neither recent nor fresh blood in the pelvis in any case. In approximately three-fourths of these cases of unruptured pregnancies or pregnancies with walled in blood or fetal products, there was *no decided increase in temperature, pulse, respiration, or polymorphonuclear leucocyte count.*

The findings at operation—Group B (leucocyte count, 10,000 to 16,000)

Cases	Per cent
5 Unruptured, without blood	9.0
23 Tubal abortions with large amount of free blood and old clots	
18 Ruptured, old fluid blood and clots	
9 Ruptured and walled in with large number of clots	90.9
55	99.9

Summary. Group B is the tubal abortion type. In nearly 91 per cent there were old fluid blood or clots in large amount in the pelvis. Only 5 cases were unruptured and showed no fresh blood. Each 1 of the 5 cases had a low total leucocyte count (10,000 to 11,000) showing the relation to Group A. Only 9 cases were walled in. Approximately three-fourths of the cases had no increase in temperature, pulse or respiration. *The polymorphonuclear leucocyte count however had risen from 20 to 50 per cent.*

The findings at operation (in detail)—Group C (leucocyte count 16,000 to 36,350) 23 cases

Incomplete tubal abortion

Cases		Per cent	
1	16,200	88	Tubal abortion—old blood and active bleeding.
2	16,350	80	Partial rupture—active bleeding and clots.
3	18,500	96	Tubal abortion—incomplete— active bleeding.
4	20,800	79	Tubal abortion—incomplete—bleeding.

Rupture and fresh blood in large amounts

5	25,400	90	Ruptured—very large amount of fresh blood.
6	20,200	79	Ruptured—fluctuating tumor mass.
7	21,350	88	Ruptured—very large amount of free blood.
8	20,400	85	Ruptured horn of uterus—fetus floating in free blood.
9	19,000	85	Ruptured—free blood—4 mos. fetus in pelvis.
10	19,600	86	Ruptured—numerous clots.
11	17,000	92	Ruptured—old clots and old fluid blood.
12	25,500	90	Ruptured—three pints of blood.
13	21,100	94	One pint fresh blood, old clots filling pelvis.
14	17,800	94	Ruptured—large amount clots and fluid blood.
15	18,900	84	Ruptured—large clots and bloody fluid.
16	16,400	84	Ruptured—free blood.
17	36,350	94	Isthmic rupture—active bleeding, enormous amount fresh blood.
18	19,900	82	Ruptured—old blood clots—fetus in sac.
19	24,100	90	Tubal abortion—fresh blood and old fluid and clots.
20	21,500	95	Ruptured—probably secondary abdominal pregnancy.
21	22,300	92	Ruptured—fresh blood and clots.
22	19,800	89	Necrotic clot in tube, ruptured.
23	26,000	92	Stump of tube (pregnant) ruptured and abdomen completely filled with fluid blood and clots.

Summary. Group C represents the recent rupture type. Operation proved that in 19 of the 23 cases rupture *had recently occurred* and that active bleeding was going on in all of the four cases which were unruptured.

In 23 cases, 100 per cent, rupture or incomplete tubal abortion with active bleeding occurred. Blood was found in very large amounts in the abdominal cavity in most of the cases.

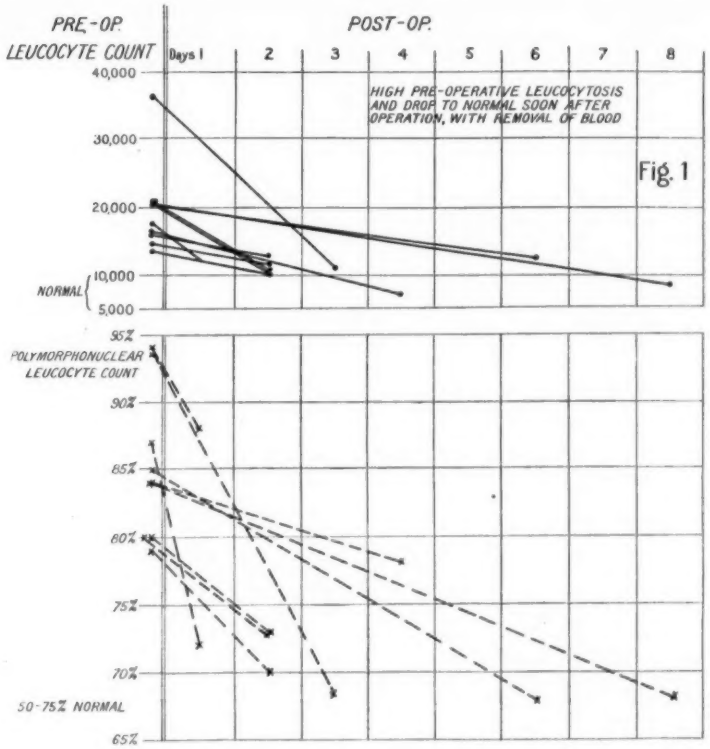
In 3 cases a fetus was found; 1 case was a secondary abdominal pregnancy. In 1 case the stump of a tube had been the site of the pregnancy and had ruptured; and in another case the horn of the uterus was ruptured.

The temperature showed hardly any variation from that in Groups A and B. The pulse was increased in 56.5 per cent of the cases, the respiration in 60.8 per cent. The total leucocyte count was increased 6,000 to 26,350; the polymorphonuclear count was above normal in every case and reached 90 per cent or over in 11 cases.

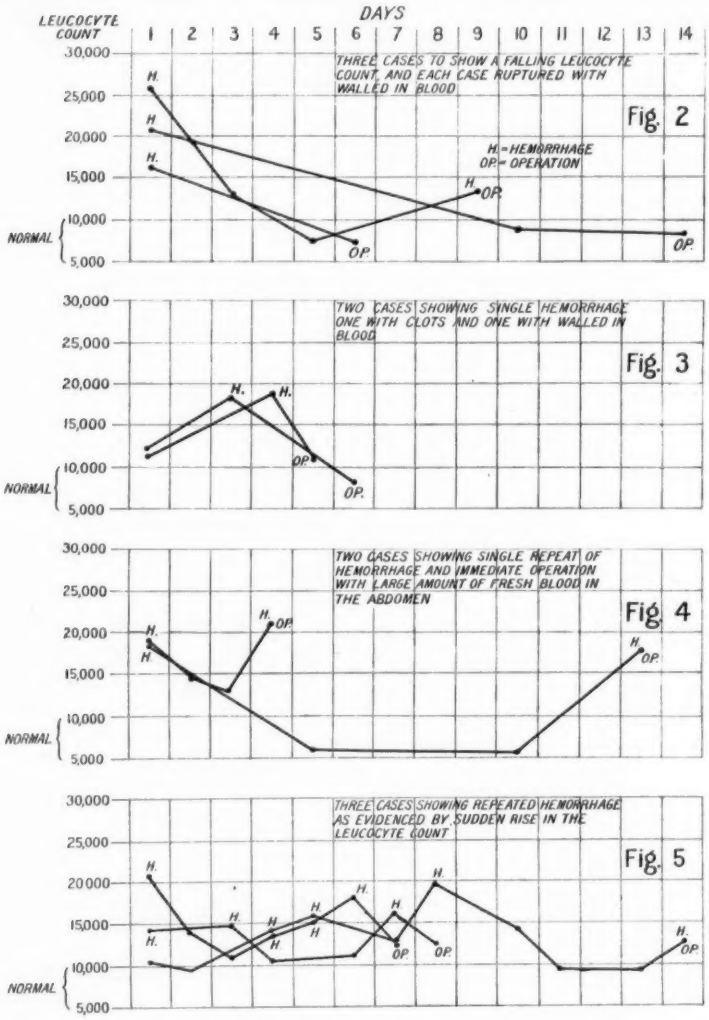
To consider briefly the chief diagnostic points in the tables made for comparison of the three groups it is evident that the temperature in these 150 cases was not greatly altered or lowered from the normal. The highest temperature in any case *before operation was 101.4 degrees F.* and a subnormal temperature was present in only a small percentage of Groups A and B and in only 16.6 per cent in Group C.

The pulse was over 110 in only 8 per cent of the cases until we reach Group C. In this group (C) 56.5 per cent of the patients had a more rapid pulse rate and 60.8 per cent had a high increase in respiration. As the comparison table shows, the polymorphonuclear leucocyte count made a definite increase from 19.4 per cent in Group A to 50.9 per cent in Group B and then to 100 per cent in Group C. While these groups were taken rather arbitrarily, it was because 10,000 is the upper limit considered normal. Clinically the cases seemed to divide themselves at a leucocyte count of approximately 16,000 with the subacute on the one hand and the very acute on the other. The very acute cases come to the hospital with a severe degree of shock or in collapse. Group A (4,500 to 10,000) is the unruptured or walled-in class and Group B (10,000 to 16,000) is the old tubal abortion type or the cases with ruptured tube, but not a recent rupture and old fluid blood or clots present in very large amounts. Group C (16,00 to 36,350) is the class with recent rupture, the patient being still in a very critical condition with free blood or active bleeding, or an enormous amount of blood in the abdomen.

The polymorphonuclear leucocyte count was found increased in proportion to the amount of fresh blood in the peritoneal cavity, and it is here that the leucocyte count seems to be of most diagnostic value. The blood may of course originate somewhere other than in a tubal pregnancy. A ruptured corpus luteum or hæmatosalpinx or any



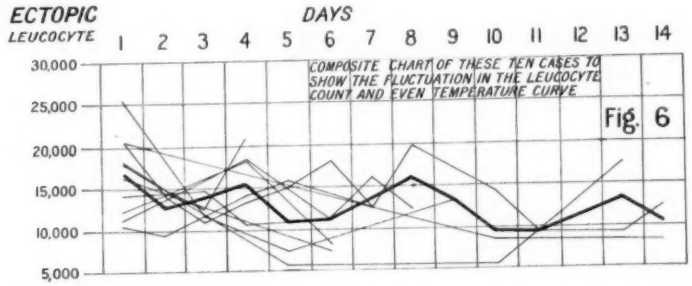
bleeding vessel would give the same white and polymorphonuclear leucocyte count when the blood is thrown into the peritoneal cavity. But in ectopic gestation the bleeding comes at intervals allowing an absorption or walling in; and a drop in the leucocyte count is usually seen soon after admission to the hospital. When the blood is removed from the abdomen at the time of operation, a previously high pre-operative count would drop quickly to normal as can be demonstrated by several cases, as shown in Figure 1. In this chart are shown the high leucocyte counts of several patients on admission to the hospital with the average leucocyte curve and post-operative drop to normal shortly after operation and the removal of blood from the abdomen. We believe that the drop in the leucocyte count occurs when the fresh blood is absorbed or walled in and Figure 2 will show the high leucocyte count and its subsequent drop in cases of ruptured tubal pregnancy with walling in of the blood and clots as proved by the operation done several days later. Figure 3 shows 2 cases in which there was a sudden rise in the white count after entrance to the hospital. Operation in 1 case the day following the hæmorrhage revealed many clots in the pelvis not walled in; and operation delayed for a few days in the second case showed a walled-in mass consisting of fluid blood and clots. Figure 4 shows 2 cases with sudden rise in the leucocyte count and immediate operation. In each case the abdomen was full of fresh blood and clots. Figure 5 shows 3 cases with several hæmorrhages and subsequent operation. Figure 6 is a composite picture of the leucocyte counts and the temperature curve of the 10 cases just described. A fluctuating leucocyte count and a uniformly low temperature has characterized the whole series of

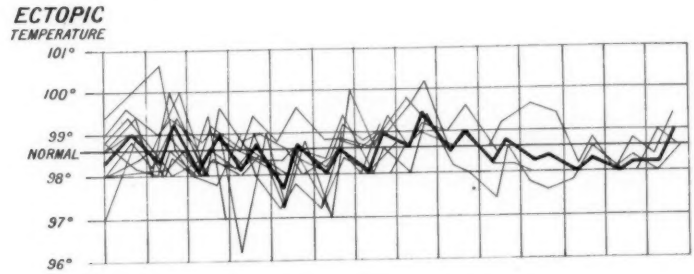

LEUCOCYTE COUNT
DAYS
1 2 3 4 5 6 7 8 9 10 11 12 13 14
30,000
25,000
20,000
15,000
10,000
5,000
NORMAL
THREE CASES TO SHOW A FALLING LEUCOCYTE COUNT, AND EACH CASE RUPTURED WITH WALLED IN BLOOD
Fig. 2
H.=HEMORRHAGE
OP.=OPERATION
H.
OP.
TWO CASES SHOWING SINGLE HEMORRHAGE ONE WITH CLOTS AND ONE WITH WALLED IN BLOOD
Fig. 3
TWO CASES SHOWING SINGLE REPEAT OF HEMORRHAGE AND IMMEDIATE OPERATION WITH LARGE AMOUNT OF FRESH BLOOD IN THE ABDOMEN
Fig. 4
THREE CASES SHOWING REPEATED HEMORRHAGE AS EVIDENCED BY SUDDEN RISE IN THE LEUCOCYTE COUNT
Fig. 5

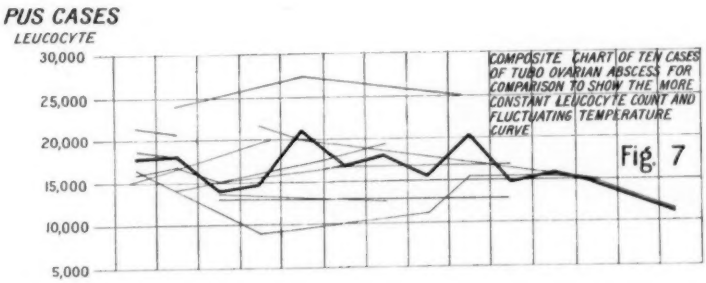
cases when patients have been in the hospital long enough to have had several white cell counts taken and when active bleeding has been going on. For comparison and differential diagnosis, the lower half of this chart shows the more uniformly high leucocyte count and the "picket fence" temperature curve of 10 cases of tubo-ovarian abscess.

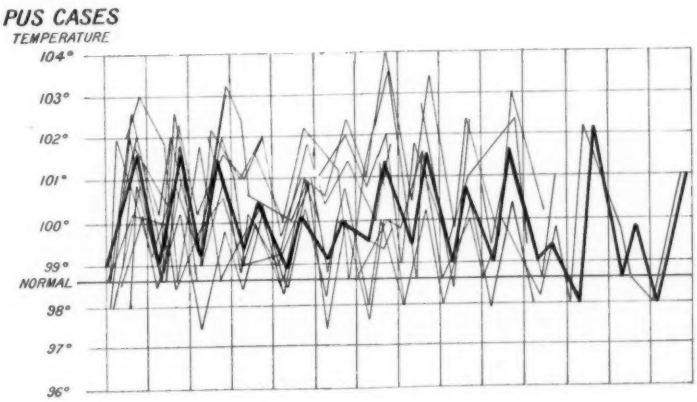
I was interested then to find what practical diagnostic value such a study has if any and Figure 7 shows the total white and polymorphonuclear leucocyte count and the temperature, pulse, respiration, and blood pressure in 2 cases of ruptured pregnancy with hæmorrhage into the peritoneal cavity. The counts were repeated just before operation and the temperature, pulse, and respiration taken again at this time.

The comparative value of the temperature, pulse, respiration, and blood pressure, and the total leucocyte and polymorphonuclear leucocyte counts in ruptured pregnancy and


ECTOPIC
LEUCOCYTE
DAYS
1 2 3 4 5 6 7 8 9 10 11 12 13 14
30,000
25,000
20,000
15,000
10,000
5,000
COMPOSITE CHART OF THESE TEN CASES TO SHOW THE FLUCTUATION IN THE LEUCOCYTE COUNT AND EVEN TEMPERATURE CURVE
Fig. 6


ECTOPIC
TEMPERATURE
101°
100°
99°
NORMAL
98°
97°
96°


PUS CASES
LEUCOCYTE
30,000
25,000
20,000
15,000
10,000
5,000
COMPOSITE CHART OF TEN CASES OF TUBO OVARIAN ABSCESS FOR COMPARISON TO SHOW THE MORE CONSTANT LEUCOCYTE COUNT AND FLUCTUATING TEMPERATURE CURVE
Fig. 7


PUS CASES
TEMPERATURE
104°
103°
102°
101°
100°
99°
NORMAL
98°
97°
96°

hæmorrhage into the peritoneal cavity is shown in the following 2 cases of ectopic gestation with bleeding.

CASE 1. No. 29,779

		Leucocyte count	Polymorphonuclears Per cent	
2-3-22	2 p.m.	20,900	84	Temperature 100.8 Pulse 120 Respiration 24 Blood pressure 110–70
2-3-22	4 p.m.	21,100	94	Temperature 101.6 Pulse 120 Respiration 24 Blood pressure 110–70

Operation: 2-3-22, 4. p.m. Findings at operation: Tubal abortion, mass of products of conception, and blood clots filling pelvis.

CASE 2. No. 24,058

		Leucocyte count	Polymorphonuclears Per cent	
1-12-20	11 p.m.	20,400	96	Temperature 96.8 Pulse 114 Respiration 20 Blood pressure 80–55
1-13-20	11 a.m.	26,000	92	Temperature 99 Pulse 116 Respiration 26 Blood pressure 112–68

Operation: 1-13-20, 11 a.m. Findings at operation: Abdomen completely filled with blood. Pregnancy in stump right tube, ruptured.

I then collected the red blood cell counts taken at the same time as the white cell counts on patients who entered the hospital with a high leucocyte count; as in a former study on shock I had found that the red cells are not appreciably lowered for a long time after hæmorrhage has begun because of the stagnation of red cells in the capillaries. The white cells seem to be more sensitive to alteration in the blood stream and to move much more quickly to the wall of the capillary than do the heavy slowly moving red cells. It seemed that the white cells might be the first to show an increase in cases of severe hæmorrhage into the peritoneal cavity. The only mention I have found in surgery of this early rapid rise in the white cell count long before the fall in the number of red cells and the percentage of hæmoglobin in hæmorrhage into the peritoneal cavity is in a case report by Dr. Lewis A. Connor and Dr. William A. Downes, "Spontaneous Rupture of the Spleen in Typhoid Fever with Operation and Recovery." The writers state: "Although before the operation the red cells showed no material change in concentration (these red cells being 5,000,000 and the hæmoglobin 85 per cent) the circulating leucocytes had already risen to 35,000." In order to compare the red cells with the white cells, complete blood counts were taken on admission of 4 patients who were in shock from ruptured tubal pregnancy as proved by subsequent operation and the complete blood counts were repeated on each patient within 2 hours. The red cells and the leucocyte counts are shown in the tables.

COMPARISON OF THE RED CELL COUNT AND HÆMOGLOBIN WITH THE TOTAL AND POLYMORPHONUCLEAR LEUCOCYTE COUNT IN CASES OF HÆMORRHAGE INTO THE PERITONEAL CAVITY.

CASE 1. No. 34052

			Per cent
4-28-24		4,040,000 red cells 9,200 leucocyte count	68 hæmoglobin 78 polymorphonuclears 140–90 blood pressure.
5-19-24	4:30 p.m.	4,320,000 red cells 17,600 leucocyte count	50 hæmoglobin 94 polymorphonuclears 65–50 blood pressure
	8:00 p.m.	4,348,000 red cells 21,500 leucocyte count	56 hæmoglobin 95 polymorphonuclears blood pressure (not obtainable)

Operation: 8:00 p.m. Ruptured tubal pregnancy—abdomen filled with fresh blood; 800 cubic centimeters blood transfusion.

Postoperative

		Per cent
Third day	3,580,000 red cells 4,200 leucocyte count	60 hæmoglobin 60 polymorphonuclears

CASE 2. No. 25150

1-31-24	2:00 p.m.	2,816,000 red cells 19,800 leucocyte count	60 hæmoglobin 84 polymorphonuclears 78–55 blood pressure.
1-31-20	4:00 p.m.	2,340,000 red cells 25,400 leucocyte count	60 hæmoglobin 95 polymorphonuclears blood pressure (not taken)

Operation: 1-31-24, 4:00 p.m. Left horn of uterus ruptured—enormous amount fresh blood and fetus. 800 cubic centimeters blood transfusion.

Postoperative

		Per cent
2-6-20	3,184,000 red cells 12,600 leucocyte count	62 hæmoglobin 68 polymorphonuclears

CASE 3. No. 34543

			Per cent
7-30-24	10:00 a.m.	4,256,000 red cells 10,000 leucocyte count	62 hæmoglobin 74 polymorphonuclears 110–65 blood pressure
7-30-24	1:00 p.m.	3,920,000 red cells 22,300 leucocyte count	54 hæmoglobin 92 polymorphonuclears 85–60 blood pressure.

Operation: 2:00 p.m. Large quantity of fresh blood—many clots and large quantity of free blood—ruptured.

CASE 4. No. 33664

			Per cent
2-13-24		3,696,000 red cells	60 hæmoglobin
		16,500 leucocyte count	84 polymorphonuclears
			135-85 blood pressure
2-14-24		14,900 leucocyte count	82 polymorphonuclears
2-15-24	10:00 a.m.	12,800 leucocyte count	76 polymorphonuclears
2-15-24	9:00 p.m.	3,584,000 red cells	52 hæmoglobin
		20,800 leucocyte count	89 polymorphonuclears
			125-80 blood pressure

Operation: 8 p.m. Tubal abortion, very large amount fresh blood.

		Per cent
2-16-24	3,480,000 red cells	64 hæmoglobin
	11,000 leucocyte count	70 polymorphonuclears

SUMMARY OF THE 150 CASES OF ECTOPIC GESTATION STUDIED AT THE WOMAN'S HOSPITAL

1. In ectopic gestation the leucocyte count fluctuates according to the amount of fresh blood being thrown into the peritoneal cavity and the rate of absorption.

2. The leucocyte count tends to drop quickly to normal as the blood in the peritoneal cavity is absorbed or walled in; 48 per cent of 150 cases of ectopic gestation had a normal leucocyte count before operation was performed.

3. The leucocyte count was normal in 29 cases of unruptured tubal pregnancy in which there was no free blood and in 43 cases of ruptured pregnancy in which the blood was walled in.

4. The leucocyte count was an index in 150 cases to the amount of free blood in the peritoneal cavity and the polymorphonuclear leucocyte count was increased markedly only in cases having fresh blood in the pelvis and increased in direct proportion to the amount of recent blood found at the time of operation.

5. The fluctuating leucocyte count together with the moderate elevation of temperature differentiates ectopic gestation from a purulent salpingitis with its more uniformly high leucocyte count and fluctuating temperature.

6. In cases of rupture of tubal pregnancy the steadily rising leucocyte count indicates active bleeding before the fall in the number of red cells or hæmoglobin gives warning of the condition.

7. The leucocyte count to be of diagnostic value must be taken at least daily and in critical cases even hourly and used in conjunction with the history and clinical findings in the case.

DUODENAL ULCER AS A COMPLICATION OF PULMONARY TUBERCULOSIS[1]

By JAMES R. LISA, M.D., Albany, New York, City

GASTRIC disturbances are of such frequent occurrence during the course of pulmonary tuberculosis that a question naturally arises as to whether such disturbances have a true anatomical basis, and if so, just how often duodenal ulcer is present in such cases.

It is not ordinarily considered that duodenal ulcer is frequent during the course of phthisis. The extensive literature on ulcer scarcely mentions its relation to pulmonary tuberculosis, and the literature on tuberculosis touches the subject very sparingly.

In a study of duodenal lesions in a large series of general autopsies performed at Guy's Hospital, Perry and Shaw (1) found only 25 cases of duodenal ulcer associated with pulmonary tuberculosis. In 11 of these cases the ulcers were tuberculous in type and in the remaining 14, non-tuberculous. Of the non-tuberculous group, 1 ulcer was healed and 3 had perforated, causing death by acute general suppurative peritonitis. The total number of tuberculosis cases in which autopsy was performed was not stated. Trier (2) reported 1 case of simple ulcer of the first portion of the duodenum with a healed pulmonary lesion. Krause (3) had 1 case of simple duodenal ulcer which had perforated and caused death. Claude's (4) case showed 7 non-tuberculous ulcers. West's (5) case had 2 simple ulcers, 1 perforated. Of Monyihan's (6) 2 cases, 1 (No. 26) had 3 tuberculous ulcers; the other (No. 305), a single ulcer. Schwatt (7) found 3 cases of duodenal ulcer in 125 autopsies, all, presumably, being tuberculous in character. Of the reports quoted, Schwatt's alone states the total number of cases of tuberculosis.

In an effort to procure additional information bearing on the relation of duodenal ulcer to pulmonary tuberculosis, the writer has reviewed two series of autopsies performed by him at the Metropolitan Hospital, New York City, covering a period of 4 years. One of the series consists of 257 autopsies on cases of pulmonary tuberculosis, including cases in which the tuberculosis was primary in other systems but also showing pulmonary involvement; and for comparison, another series of autopsies numbering 209 cases which showed no tuberculosis.

The following cases, with duodenal ulcers, are taken from the first series.

Case 1. J. D. C., white, male, South American, age 20, laborer, had been ill 10 months. There was no marked gastric disturbance. Autopsy. In the first part of the duodenum was a small round ulcer with a pinpoint perforation. The surrounding serosa was covered with a fibrinous exudate. The tuberculosis was the direct cause of death; the peritonitis was very early and limited in extent.

Case 2. H. A., white, male, South American, age 27, seaman, gave length of illness as 2½ years. The chief complaint throughout the disease was chest and epigastric pain. Autopsy. (Fig. 1.) Seven shallow, round, and irregular ulcers of varying size, with smooth edges and clean black bases, involved the duodenum from the pylorus to the ampulla. Microscopic examination. (Fig. 2.) The base is formed by the muscular coats and is covered by a thin necrotic layer. The edge is even. The cell infiltration of the base is very moderate and consists of lymphocytes and endothelial cells.

Case 3. D. E., black, female, Porto Rican, age 25, housewife, gave the length of illness as 2½ yrs. There were no marked gastric symptoms. Autopsy. In the first part of the duodenum on the posterior wall was a round ulcer, with edges raised and slightly irregular, and center depressed.

Case 4. A. G., black, female, a British West Indian, age 28, was a housewife. The total length of illness was 1 year. There had been epigastric pain during the early morning and late evening, and occasionally in the course of the day. Autopsy. Just below the pylorus was a large roughly circular depressed ulcer on the posterior wall. The under surface was firm. Near this ulcer was a second one similar in character which had perforated. Its edges were smooth and shiny and there was no evidence of inflammatory reaction. (A post-mortem perforation.) Microscopic examination. The edge was sloping and even. The base was formed by the muscular coats and was covered by a narrow layer of necrotic tissue. The cellular reaction was moderate and consisted of endothelial leucocytes, a few polymorphonuclear cells and lymphocytes. The blood vessels were slightly dilated and contained an

[1]From the Bender Hygienic Laboratory, Albany, N. Y.

Fig. 1. Case 2. Showing multiple irregular ulcers, *U*, situated in the upper portion of the duodenum from pylorus, *P*, to ampulla, *A*.

increased number of polymorphonuclear leucocytes. The arterial walls were normal.

CASE 5. G. K., black, female, British West Indian, age 34, was a chambermaid. The length of illness was 5 months. There were no marked gastric symptoms. Autopsy. On the posterior wall of the duodenum 0.5 centimeters from the pylorus was an irregular ulcer with thickened, raised, rather soft, slightly undermined edge and irregular depressed base. Microscopic examination. The base of the ulcer was formed by the muscular coats and was covered by a thin even necrotic layer containing several small clumps of cocci located fairly well down toward the muscle. The edges were sloping, as a rule, and showed only slight tendency to undermining. The cellular infiltration, consisting of endothelial leucocytes, lymphocytes, plasma cells and a very occasional polymorphonuclear leucocyte, was fairly dense and involved the muscular coats. The epithelium at the edges was slightly hyperplastic. The small arteries in the base and edges presented distinctly thickened walls.

Fig. 2. Case 2. (Low power.) Section through edge of one of the ulcers showing the necrotic base, the slight tendency to undermining of the edge, and the moderate cellular infiltration.

CASE 6. J. L., white, male, Russian, age 36, was a laborer. The duration of illness was 7 months; history unobtainable. Autopsy. The first part of the duodenum had a large circular ulcer the size of a silver half dollar 0.5 centimeters below the pyloric ring. The base was fairly smooth and adherent to the pancreas. The edges were heaped up, irregular, nodular, fairly firm. In one portion was a distinctly yellowish-grey pea-sized caseous area. This case also had multiple gastric ulcers. Microscopic examination. In area A (Fig. 3) was a distinct focal caseation necrosis involving the mucosa, submucosa, and muscular layers, separated from the pancreas by thickened connective tissue. This area was surrounded by a zone of small lymphocytes and endothelial cells. The remainder of the ulcer presented a different picture. The edge was hyperplastic and even. The base was formed by the muscular layers. The cell infiltration was fairly heavy and consisted of endothelial and lymphocytic cells. The vessels were normal.

CASE 7. L. K. was a Chinaman, male, age 30, occupation unknown. The duration of illness was 5 years. A history was unobtainable. Autopsy. In the first part of the duodenum were four irregular ulcers with jet black smooth bases and slightly raised, fairly firm edges. Microscopic examination. (Fig. 4.) The base was formed by the muscular layers. The edges were smooth and slightly sloping. The cellular reaction was very slight. The arteries were negative.

CASE 8. H. F. was a white male, a South American, age 22, occupation unknown. The duration of illness was 3 weeks. There were no marked gastric symptoms. Autopsy (Fig. 5.). In the first part of the duodenum were two small shallow clean ulcers with sloping edges and black bases. Microscopic examination. The edge and base were even. The base rested on the muscular coats and was covered by a narrow

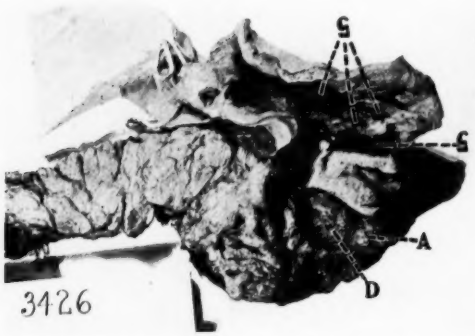


Fig. 3. Case 6. Showing the large duodenal ulcer, *D*, with the tuberculous area, *A*, and the gastric lesion, *G*.

necrotic layer. The cellular reaction was very scanty, consisting only of a very occasional endothelial leucocyte. The submucosa had a moderate fibrosis. Its small arteries showed some fibrosis of the walls.

CASE 9. L. G., black, female, British West Indian, age 33, was a housewife. The duration of illness was unknown. There were no marked gastric symptoms. Autopsy. In the first part of the duodenum, below the pyloric ring, were two irregular shallow ulcers. The bases were smooth, the edges even. Microscopic examination. The edges were sloping. The base was formed by the muscle, was slightly irregular and covered by a necrotic layer. The cell infiltration was moderate and consisted of lymphocytes, endothelial cells and a few polymorphonuclear leucocytes. The vessels were negative.

By comparison, in the second series embracing 209 cases showing no tuberculosis, but 4 cases of duodenal ulcer were found. The associated lesions in these instances were chronic glomerulonephritis, chronic diffuse nephritis and acute purulent pericarditis, broncho-pneumonia, and syphilis of the heart and aorta. In the last case the ulcer had perforated, death being due to acute general suppurative peritonitis.

DISCUSSION

A history of gastric disturbances was elicited in but 3 of the 9 ulcer cases reported. The anamnesis was a routine one and no special effort was made to establish a diagnosis of ulcer.

All of the ulcers were located in the upper part of the duodenum, between the pylorus and the ampulla of Vater. All were simple and not tuberculous in character. Five of the 9 cases showed multiple ulcers. One case only,

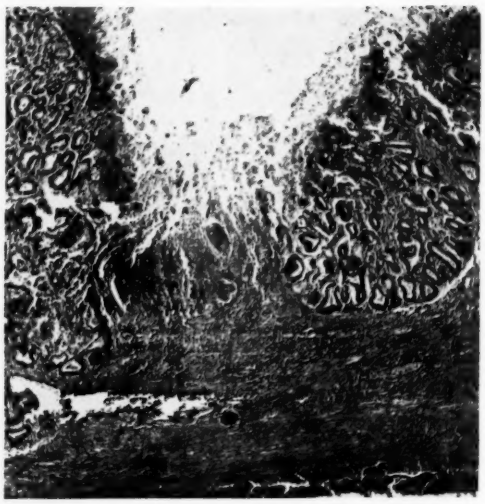


Fig. 4. Case 7. (Low power.) Section through the ulcer showing the necrosis of epithelium and the very moderate cellular infiltration.

Case 6, had an added tuberculous involvement; this was evidently implanted on a preexisting simple ulcer and involved only a very small portion of the ulcer itself.

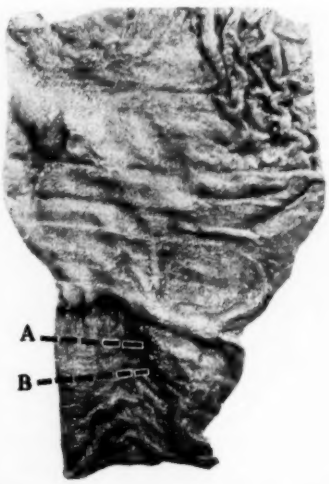


Fig. 5. Case 8. The two irregular shallow ulcers, *A* and *B*, immediately below the pylorus.

The pulmonary tuberculosis, in all cases, with one exception, Case 8, was of an extremely

chronic form. In Cases 5 and 6, which clinically had histories covering only 5 and 7 months respectively, the lung lesion appeared to be of much longer duration. One case only, Case 8, showed an acute pneumonic form of tuberculosis. It was of interest to note that the cases of pulmonary tuberculosis showed a marked tendency to secondary infection, a factor possibly being the contributing cause of ulcer on an embolic basis.

CONCLUSIONS

While the total number of autopsies (466) upon which this report is based is hardly sufficient to warrant positive final conclusions, the following deductions bearing on the relation of duodenal ulcer to chronic pulmonary tuberculosis may be drawn from this review of cases.

1. Duodenal ulcer is found at autopsy more frequently with pulmonary tuberculosis than with any other disease.
2. The ulcer is usually non-tuberculous in character.
3. Pulmonary tuberculosis associated with duodenal ulcer is of usually chronic form.
4. The age of most frequent occurrence of ulcer is 25 to 35 years.
5. Careful gastric histories in cases of pulmonary tuberculosis, checked by radiological findings, will probably reveal duodenal ulcer in a greater number of cases than is now diagnosed.

BIBLIOGRAPHY

1. PERRY, E. C., and SHAW, L. E. Guy's Hospital Reports, 1893, l, 64.
2. TRIER. Quoted by Moynihan.
3. KRAUSE. Quoted by Moynihan.
4. CLAUDE. Quoted by Moynihan.
5. WEST. Quoted by Moynihan.
6. MOYNIHAN. Duodenal Ulcer. 1912, ed. 2.
7. SCHWATT. Am. Rev. Tub., 1923, viii, 9.

TOTAL GASTRECTOMY

WITH REPORT OF A CASE OF LINITIS PLASTICA TREATED BY A COMPLETE EXCISION OF THE STOMACH

BY MONT R. REID, M.D., CINCINNATI, OHIO

THE idea of total gastrectomy apparently originated with Czerny, who in 1875 suggested that certain lesions of the stomach might best be treated by the complete removal of this organ. In 1880, Albert practiced the operation of total gastrectomy upon human cadavers. The first attempt to perform this operation upon the living human being was made by Conner in 1883. Although his patient did not survive the operation it is pleasing to learn that in the literature of gastric surgery he is rightfully honored as the first surgeon to have the courage to follow his conviction that certain lesions are best treated by the total extirpation of the stomach. This was in the early days of gastric surgery when even the operation of partial gastrectomy (first performed by Péan in 1879, and first successfully by Billroth in 1881) was exceedingly rarely performed, and its value much questioned. It is, therefore, not surprising that 14 years elapsed before another case of total gastrectomy was reported.[1] Schlatter in 1897 reported the second case. His was the first successful case, the patient having lived for 14 months after the operation. Soon after this, MacDonald, Brigham, Brooks, Richardson, and others reported successful cases.

Charles H. Frazier (1900) in a critical summary of the literature on the surgery of the stomach collected 9 cases of total gastrectomy. By 1906, Herbert J. Patterson found that the number of cases had increased to 27. In 1911 Trinkler collected and carefully tabulated 26 cases of total gastrectomy, giving the late results. He evidently failed to find in the literature a few cases previously reported by Patterson. The next summary of reported

[1] In Conner's original report (1884) the author said that two other total gastrectomies had been performed since his attempt; I can find no reference to these cases in the literature.

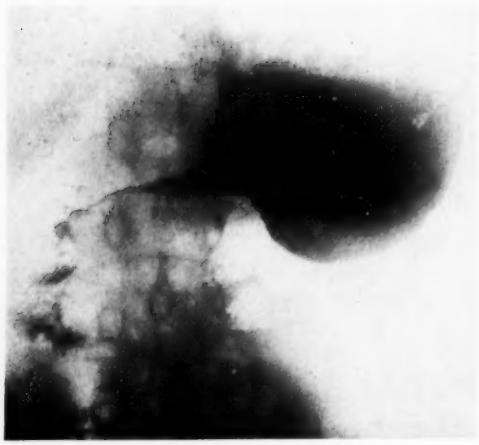


Fig. 1. Roentgenogram of the stomach, author's case. Note the long, narrow, smooth lumen of the pyloric region and the relatively small or undilated fundus. In the more advanced cases of linitis plastica the fundus is also contracted to a small tube.

cases appeared in 1922, by Kreuter, who collected 44 cases. Rost (1923) says that some 40 cases have been reported but that the number is probably a little larger. It has been stated that the number is more accurately about 50 at the present time. The rarity of the operation and the surprisingly good results that follow it prompt me to report the following case:

C. M., a white woman, age 51 years, was admitted to the Cincinnati General Hospital, November 8, 1924, with the complaint of stomach trouble. Our studies revealed a small fundus and a long narrowed pyloric region with an almost complete obstruction (Fig. 1). This very long obstruction together with the small capacity of the stomach made us feel that the lesion of the stomach was very extensive, if, indeed, it did not involve the entire stomach. Contrasted with this extensive lesion was the patient's general condition, which, except for dehydration and emaciation, was good. She had lost 45 pounds in weight. The blood examination revealed 5,500 white cells, 5,000,000 red cells, 85 per cent hæmoglobin, a normal differential count, and a negative Wassermann test. One hour after the ingestion of an Ewald test meal, 50 cubic centimeters of fluid were recovered from the stomach in which the free hydrochloric acid was 20 per cent, and the total acid 38 per cent. In one specimen of vomitus the acidity percentage was the same, and there was considerable blood. Examination of the urine and fæces revealed nothing abnormal. So far as we could judge by physical examinations and by the use of X-rays, there were no metastases from a possible malignant growth of the stomach.

The symptoms of stomach trouble, mainly belching, a sour stomach, and vomiting had been present for a little longer than a year. For the past 2 months she had vomited practically all food and fluids—the vomiting occurring almost immediately after the taking of food.

Although the X-ray picture made us doubt that any relief could be obtained by an operation, it was thought best to make an exploratory incision into the abdomen. To prepare the patient for the operation several thousand cubic centimeters of salt solution were given subcutaneously during the 2 days prior to operation.

Operation by the author, November 17, 1924. Ether anæsthesia was used. The stomach was found to be very small and extremely hard and leathery throughout its entire extent. Near the pylorus the consistency of the lesion was almost cartilaginous. There was no gross evidence of any extension of the pathological process outside of the stomach. The stomach was so nearly reduced to a small hard fibrous tube that it was evidently impossible to give relief either by a gastro-enterostomy or a partial resection of the stomach. I, therefore, decided to attempt not only to relieve the obstruction but to cure the condition by removing the entire stomach. To get a better exposure the abdominal wall was divided transversely from the right rectus incision to the left costal margin. The entire stomach was then removed. This was not difficult for it was not adherent to the pancreas, nor were the adhesions between the stomach and spleen very firm. Restoration of the continuity of the alimentary tract, as illustrated in Figure 2, especially the end-to-end anastomosis between the distal end of the divided jejunum and the œsophagus was, however, quite difficult because of the depth of the wound and the absence of a serous covering on the posterior wall of the œsophagus. Both the œsophagojejunal and jejunojejunal anastomoses were made with interrupted Halsted mattress sutures of silk. The blind end of the duodenum was inverted by similar sutures (Fig. 2). The time required to perform the operation was 3 hours. No blood, however, was lost and at the completion of the operation we found our patient with a pulse of 90 and in good condition.

Throughout her convalescence the patient's general condition was good, the temperature remaining normal and the pulse rate being between 80 and 90. For 5 days after operation nothing was given by mouth, but fluids and some nourishment were given both subcutaneously and by rectum. On the sixth day distilled water, 1 ounce, was given by mouth every hour, and on the eighth day orange albumen and peptonized foods in the same amount were begun. On the tenth day she began taking water when she desired it, but was cautioned to drink slowly; and her food in the form of peptonized milk, cream, orange juice with lactose, etc., was increased to 750 calories. Within a month a general soft diet

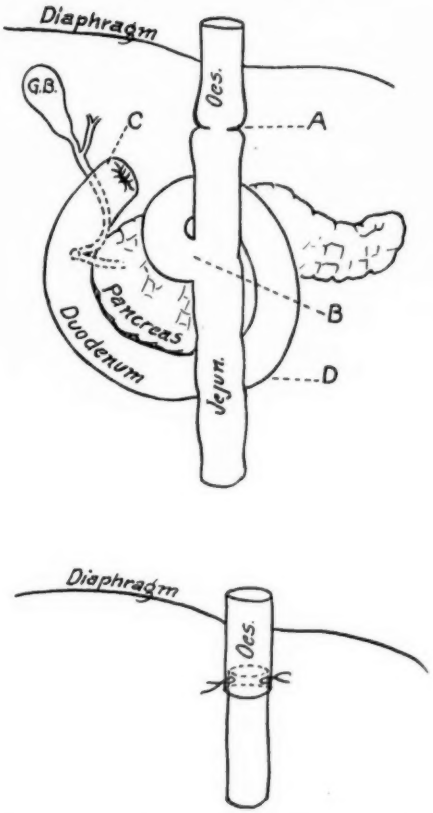


Fig. 2. Diagram to illustrate the author's method of restoring the alimentary tract after complete excision of the stomach. A, Œsophagojejunal anastomosis. B, Jejunojejunal anastomosis. Note that this anastomosis is made at an angle which will tend to prevent the blind gut from filling with food. D, Position of Treitz's ligament. C, Blind end of duodenum.

in small amounts supplemented by intermediate nourishment of egg-nogs, candy, ice cream, etc., was permitted.

She has continued to take a soft diet and has gained in weight. She has not vomited, and has recovered her health and strength to such an extent that she is doing her own housework. The only discomfort she experiences now is a sensation of fullness after eating small amounts of food. She is, however, gradually taking more food at a time.

The only medication consisted of dilute hydrochloric acid, minims 10, and pepsin solution, 1 cubic centimeter, three times a day. Since leaving the hospital the patient has continued to take the hydrochloric acid but has discontinued the use of the pepsin solution.

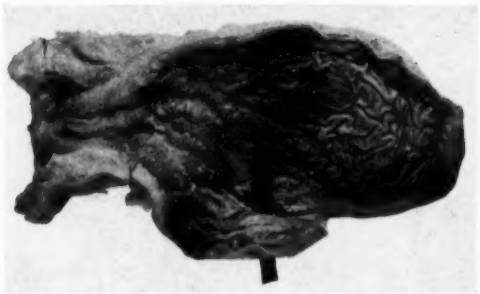


Fig. 3. The entire stomach (author's case). Note its size and thickened walls. The mucosa is atrophied in the pylorus; in the rest of the stomach it is thrown into large folds and apparently hypertrophied. The tape is through the cardia of the stomach.

The greatest anxiety during her convalescence was occasioned by the development of a severe stomatitis on the eighth day. This was a serious complication for almost 10 days and it was nearly 4 weeks before the mouth was entirely well. The recovery from the stomatitis was due, I think, to the almost constant attention of the residents, internes and nurses who carefully cleansed and oiled the mouth every few hours. It is doubtful if the many things used, such as potassium chlorate, hydrochloric acid, sodium bicarbonate, compound tincture of myrrh, etc., were as instrumental in her recovery as was the careful mechanical cleansing of the mouth. In many of the reported cases of total gastrectomy stomatitis has been a serious and occasionally a fatal complication.

A study of the stomach revealed a diffuse sclerosing type of scirrhus carcinoma which involved all of the stomach except a small portion of the fundus. The mucosa, thrown into large folds and rather redundant in appearance, was everywhere intact except in the pyloric region where there had occurred a marked atrophy of the mucosa, due apparently to pressure from the constricting muscular walls. The wall of the pyloric portion of the stomach was very firm and fibrous; the remaining wall was distinctly "leathery" in consistency. Grossly the process was typical of linitis plastica or a "leather-bottle stomach" (Fig. 3). Histologically the pathological change is a diffuse scirrhus carcinoma. The cancer cells are better preserved and rather more numerous than one usually observes in typical cases of linitis plastica (Figs. 4 and 5). Indeed, in some cases the fibrosing process is so marked that it may be difficult to recognize or definitely to find any cancer cells. Judging from the number of cancer cells and their good state of preservation we are inclined to believe that in our case the pathological change has developed comparatively rapidly and that the prognosis is consequently not so good as in the more fibrous types of linitis plastica. However, the removed lymph glands do not show any evidences of metastases.

Fig. 4. Photomicrograph (low power) of the stomach wall showing the large amount of fibrous tissue and relatively few cancer cells.

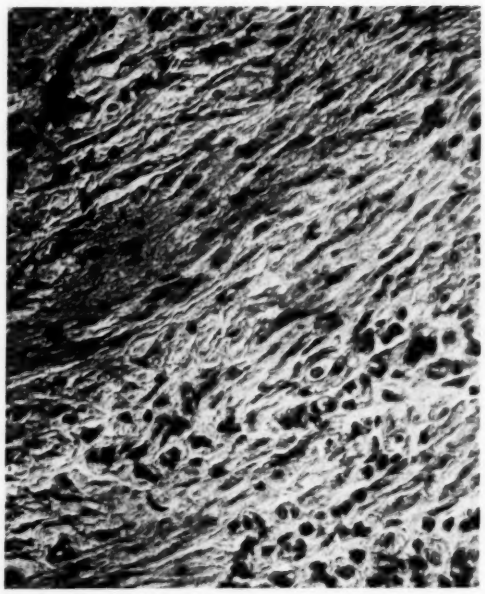


Fig. 5. Photomicrograph (high power). The cancer cells are more numerous and better preserved than in many cases of linitis plastica.

REMARKS

Previous to Schlatter's report of a successful total extirpation of the stomach there had been considerable argument as to whether or not a portion of the stomach was essential to life. Such arguments ceased after his report.

With the demonstration that total extirpation of the stomach was compatible with life, attention became focused upon the possible digestive and mechanical readjustments following the operation. Studies along these lines have been reported by De Fillippi, Cohn, Trinkler, and others. One of the main functions of the stomach is to act as a reservoir for food which can be released gradually and in small amounts into the duodenum. Patients usually compensate for this loss of function by taking frequent small quantities of food. However, several observers, especially Cohn, have noted that the lower œsophagus and duodenum (or jejunum) dilate following a total gastrectomy, and that consequently the capacity for food gradually increases. By some authors this dilatation has been ascribed to the destruction of the vagus fibers at the time of operation. In our case, now 4 months after the operation, no dilatation of either the œsophagus or jejunum is demonstrable. Yet the patient is able to eat, though rather slowly, three average meals a day without developing a marked sensation of pressure in the abdomen. The mechanical or macerating effect of the stomach upon food must be compensated for by a proper preparation of the food. It has been shown also that the secretory functions of the stomach can be assumed by other parts of the digestive apparatus. For instance, the function of pepsin is replaced by trypsin; and the other less important enzymes, such as renin, are present in the pancreatic and intestinal juices. The antiseptic action of hydrochloric acid is partially assumed by the bile. Though many patients have been given hydrochloric acid after a total gastrectomy it is doubtful if such therapy is either necessary or advisable. Many patients with a total

Fig. 6. Roentgenogram of the author's case 2 months after a total extirpation of the stomach. A, Œsophago-jejunal anastomosis.

anacidity of the stomach get along without any discomfort, and not a few gastro-enterologists consider it unwise always to prescribe hydrochloric acid when such a condition is discovered. The slight resorptive power of the stomach is very readily assumed by the intestines.

Among the effects of a total gastrectomy constipation has been noted. This was observed both by Unger and Schlatter, and Cohn suggested that it was the result of cutting vagus fibers. In our case constipation, which was present before the operation, has disappeared, and bismuth passes normally through the small intestines into the large. Explanation for the stomatitis after a total gastrectomy is not, so far as I can learn, known. Perhaps some reflex effect upon the salivary glands may be responsible for it. Certainly it was a serious and annoying post-operative complication in our case.

The operations of total gastrectomy have all been performed for carcinomata. Certainly the type of growth most favorable for this

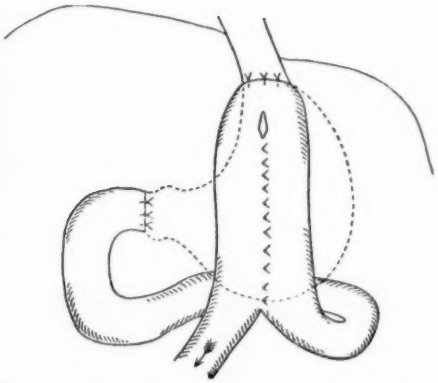


Fig. 7. Hoffmann's method for re-establishing the alimentary tract after total gastrectomy. The entero-anastomosis between the jejunal loops creates a large reservoir for food.

operation is the slowly growing carcinoma without any or, at least, extensive metastases. The most ideal lesion demanding a total extirpation of the stomach, is the sclerosing scirrhus carcinoma known as linitis plastica or "leather-bottle" stomach. In most clinics this condition is regarded as inoperable, inasmuch as relief cannot be obtained by any of the ordinary procedures, such as a gastro-enterostomy or a partial resection of the stomach. The condition develops slowly, symptoms usually being present for a year or longer and the result is almost always death from starvation. Metastases rarely occur. The diagnosis should be suspected whenever a patient gives a long history of stomach trouble, has a relatively normal gastric juice and the X-ray shows a tubular stomach with a very small smooth lumen. In addition, anæmia is not usually present and the patient's general condition is good except for the loss of weight. I mention these points in diagnosis for patients presenting such symptoms and physical findings, especially the characteristic X-ray picture, should come under the care of surgeons who have the ability and courage to perform total gastrectomies.

In Kreuter's study of 44 cases of total gastrectomy the œsophagus was anastomosed to the jejunum 20 times and to the duodenum 13 times. In 5 instances the type of operation

was not stated, while in 6 cases a makeshift operation, such as a duodenal or jejunal fistula, was performed. In the more recent cases a decided preference has been shown for the œsophagojejunal anastomosis. Viktor Hoffmann has recently published a method of reconstructing a reservoir out of the jejunum following an operation in which the stomach is totally removed (Fig. 7).

RESULTS

Patterson found that 17 per cent of the patients who recovered from the operation of total gastrectomy were alive and well 5 years later. At the time of his report, MacDonald's patient had been well and working on a farm for 7 years and Brooks' patient had been living 8 years. In this author's study the results of total gastrectomy were better than those of subtotal gastrectomy. The operative mortality of total gastrectomy was found by Frazier to be 33 per cent and by Patterson 36 per cent.

Unless many unsuccessful cases have not been reported, these statistics make the operation of total gastrectomy feasible and indicated in properly selected cases.

In view of the enormous increase in surgical work upon the stomach and the refinement of surgical technique, it is rather surprising to learn that the number of reported cases of total gastrectomy has not been as great since 1906 as it was in the 10 years prior to that time.

REFERENCES

Cohn, M. Roentgenuntersuchung einer Frau welcher der Magen und beide Nervi vagi reseziert worden sind. Berl. klin. Wchnschr., 1913, ii, 1303, 1393.

Conner, P. S. Proc. Cincinnati Academy of Medicine. Med. News, 1884, xlv, 578.

Idem. Proc. Cincinnati Academy of Medicine. Cincinnati Lancet & Clinic, 1884, xii, 637.

de Filippi, F. Untersuchungen ueber den Stoffwechsel des Hundes nach Magenexstirpation und nach resection eines grossen Theils des Dunndarms. Deutsche med. Wchnschr., 1897, xxiii, 780.

Frazier, C. H. A critical summary of the literature on the surgery of the stomach. Am. J. Med. Sc., 1900, cxix, 565.

Hoffmann, Viktor. Eine Methode des "plastischen Magenersatzes." Zentralbl. f. Chir., 1922, xlix, 1477.

Kaiser, F. F. Beitrage zur den Operativen am Magen. Czerny. v. Beitr. z. operativen Chir., 1878.

Kreuter, E. Ueber die Totalexstirpation des Karzinomataesen Magens. Deutsche Ztschr. f. Chir., 1922, clxxii, 361–365.

Patterson, H. J. Gastric surgery. Lancet, 1906, i, 491.

Rost, F. Pathological physiology of surgical diseases. Translated by S. P. Reimann. Philadelphia: Blakiston's Son & Co., 1923, p. 66.

Schlatter, C. Ueber Ehrnaehrung und Verdauung nach vollstaendiger Entfernung des Magens; Oesophagoenterostomie beim Menschen. Beitr. z. klin. Chir., 1897, xix, 757–76; also Cor. bl. f. schweiz. Aerzte 1897, xxvii, 705; translated, Lancet, 1898, i, 141.

Idem. A unique case of complete removal of the stomach; successful œsophago-enterostomy; recovery. Med. Rec., 1897, lii, 909.

Trinkler, N. Zur Frage der Totalenexstirpation des Magens. Arch. f. klin. Chir., 1911, xcvi, 536.

Unger, E. Ueber totale Entfernung des Magens. Deutsche med. Wchnschr., 1913, xxxix, 500.

DEPARTMENT OF TECHNIQUE

THE TECHNIQUE OF TONSIL OPERATION

By ELLIOTT H. HUTCHINS, M.D., F.A.C.S., Baltimore, Maryland

"ONE of the chief functions of surgery is the management of wounded vessels, the avoidance of hæmorrhage. The only weapon with which the unconscious patient can immediately retaliate upon the incompetent surgeon is hæmorrhage. If he bleeds to death, it may be presumed that the surgeon is to blame; whereas if he dies of pneumonia, peritonitis or other infection, or from an unphysiological performance, the surgeon's incompetence may not be so evident."

As a student I found it difficult to reconcile the above dictum of the late William S. Halsted with what I saw in those days in the laryngological clinic. I could not understand the reason for such rigid hæmostasis in operations upon the thyroid or appendix or for hernia when so little effort was made to control bleeding in operations upon the nose and throat. Indeed, I was tempted to conclude that the question of paramount importance was not the amount of blood that was lost, but the special field through which the loss occurred.

Since that time, however, surgery of the throat has made rapid progress. Observation convinces me that in practically all hospitals the amount of good work is increasing and that of an inferior type decreasing. Nevertheless, the rate of morbidity and operative mortality, mostly unrecorded, if known, would probably convince one of the need of further discussion in this special field.

The writer is not a throat specialist, but has had thrust upon him a relatively large number of throat cases along with other work in a rural hospital where versatility is a necessity rather than a choice. In this work certain obstacles occasioned by environment stimulated special interest in the subject, with the object that any untoward result occasioned by the handicap might be anticipated and thereby obviated.

Were it possible to tabulate accurately the number of deaths resulting from septicæmia, pulmonary infections, and various other metastatic conditions occurring in patients from whose throats the first line of defense, the tonsils, had been removed; and to say what the result would have been had the tonsils been able to engage the invading organisms for a time sufficient to enable the body to react, I believe the balance of evidence would be so decidedly in favor of the importance of their rôle in the body economy that there would be a decided tendency to leave the tonsils in very young children undisturbed until their fighting force is clearly on the wane. In other words, I feel that there are too many children under the age of 6 from whose throats tonsils are being removed, before their defensive power has been used up, or before the tonsils have become a menace to the body from infection and absorption. Of course, many exceptions to this rule are conceded.

The choice of time to operate following an acute infection would seem to deserve more consideration than it now receives. The writer not long since saw a patient suffering from painful, acutely inflamed joints, preparing to go to the hospital the next day to have his tonsils removed. The reason for objection is so obvious that it needs only to be mentioned. Next to the proper diagnosis and selection of time for the operation, discussion of the management of such cases may be productive of benefit.

As has been insisted upon by many authors, tonsillectomy as a surgical procedure is too lightly regarded. I believe it to be an incontrovertible fact that the mortality following throat operations is higher than that following any other so-called clean case, or cases in which there is a choice of time to operate.

I believe also that the morbidity, including incomplete removal of lingual and faucial tonsils and adenoid tissues together with the damage to pillars and other adjacent tissues, is greater than obtains in any other operation upon the body except perhaps operations for abdominal adhesions.

The high operative mortality will undoubtedly be affected favorably when we accept and utilize the fact that the throat patient is about to un-

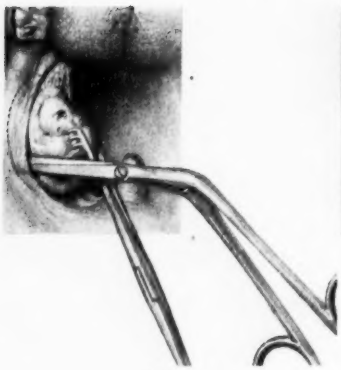


Fig. 1.

Fig. 1. Position of operator at head of table. Tenaculum (Andrews) used in operation showing the straight shank and long teeth with space between sufficiently wide to allow bulging of the tonsillar tissue between the teeth. The manner in which the tonsil is seized and the direction followed. Scissors (Knight's nasal) in position to be inserted into the line of cleavage between the tonsil and pillar after the mucous membrane has been divided close to its junction with that of the pillar.

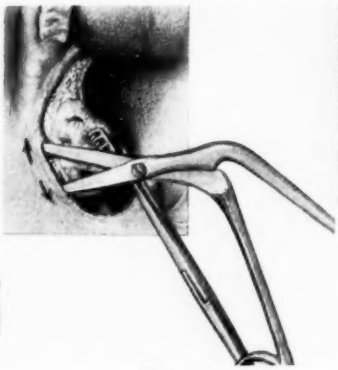


Fig. 2.

Fig. 2. Dissection with the backs of the blades of the scissors, isolating and exposing the tonsillar artery from above.

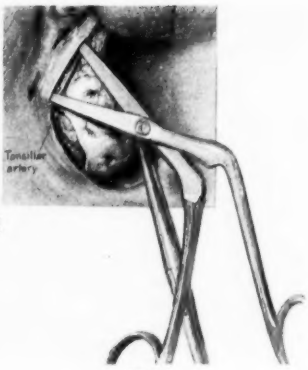


Fig. 3.

Fig. 3. Scissors in line of cleavage after the incision in the mucous membrane had been prolonged. The tonsillar artery is exposed from below.

dergo an ordeal more exacting possibly, during the operation and convalescence, than awaits one who is to be operated upon for a recognized major condition. Is there any logical reason why a throat patient should be deprived of routine preoperative investigation any more than another about to undergo a major operation? Rather would it seem that repeated infections which have

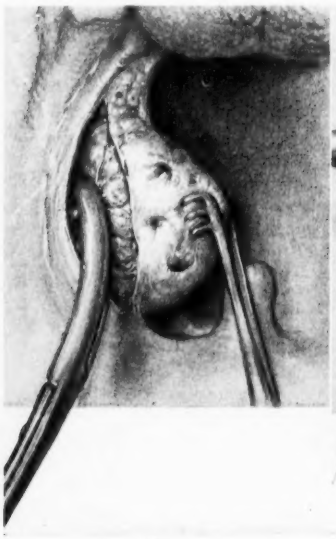


Fig. 4.

Fig. 4. Tonsillar artery being clamped.

Fig. 5.

Fig. 5. Shows a prolongation of the dissection down to and around the lingual tonsil. Kelly clamp applied to the small artery running to the lingual tonsil.

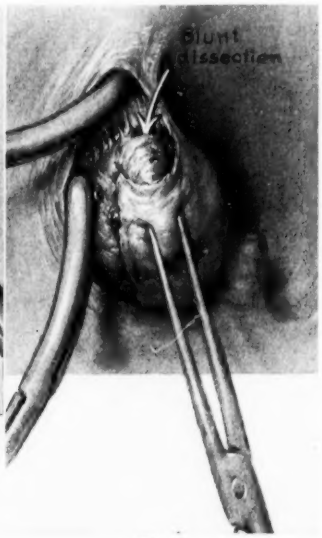


Fig. 6.

Fig. 6. Shows a change of the tenaculum, or Ochsner clamp, by which the lingual tonsil is seized and folded upon itself so that the faucial tonsil is drawn upward and forward.

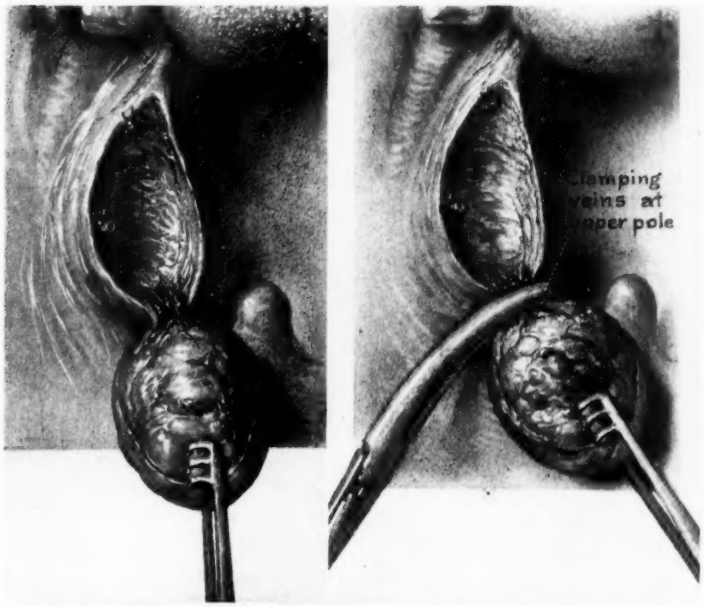


Fig. 7 (left). Shows plexus of veins at the upper pole of the faucial tonsil and the stumps of the two arteries which have been divided and ligated.
Fig. 8. Kelly clamp grasping the large veins at the upper pole.

damaged the tonsils sufficiently to justify their removal might also have damaged other organs.

In no other operation would it seem more difficult to select the proper anæsthetic than in throat cases. Indictment may justly be made against both local and general anæsthesia, if all cases are to be handled alike. Against local anæsthesia, on the one hand, stands the fact that death has followed the application of cocaine to the mucous membrane of the throat grievously often, and while one cannot say that the accident is entirely due to the anæsthetic, the strength of indictment is increased by the fact that the writer knows of cases, too numerous, in which death occurred before the operation had begun. On the other hand, one is fortunate indeed who has occupied the field of throat surgery for any length of time if he has been spared the horror of discovering during convalescence in one of his tonsil cases a metastatic abscess in the chest. According to some thoracic surgeons, notably, Ambrose L. Lockwood of Toronto, the burden of proof in this offense is decidedly upon general anæsthesia.

Both local and general anæsthesia have been tried by the writer and it is only fair to state that, while tonsils may be removed very well under local anæsthesia, only exceptionally has it been as satisfactory as general anæsthesia. General anæsthesia, with the Griffith Davis mouth gag in the hands of a specialist in anæsthesia, in my experience, leaves but little to be desired, not only because the administration of the anæsthetic is easier, but also because the operative field is exposed in a manner otherwise unsurpassed.

Before beginning a throat operation it would seem, among other things, that the operator should fully appreciate the following points:

It is impossible to eliminate the presence of organisms from the operative field. The bacterial flora of the mouth prima facie offers perhaps the worst operative environment of any part of the body. However, in all probability the presence of the great number of organisms is compensated for in a measure by special resistance of the tissues in the surrounding vicinity. If infection is to be prevented this must be accomplished by adding to the general body resistance the benefits accruing from proper respect for the tissues of the throat, through gentleness of manipulation, adequate hæmostasis, the production of a minimal mass of tissue necrosis (consistent with rigid

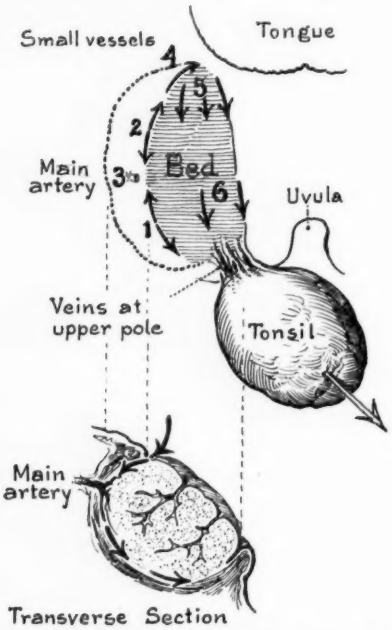


Fig. 9. Diagram showing the direction of the dissection and the order of procedure. Lower cut: transverse section of the tonsil and the probable location of the tonsillar artery.

hæmostasis). The operator should clamp the arteries before dividing them instead of digging down into the tissues in order to catch a telescoped vessel which has been divided; avoid the introduction of organisms into the depths of tissue on needles; and lastly, but of great importance, he must be sure that he is capable of executing a rapid and clean ligation of the carotid if occasion should demand.

With these data in mind the writer has used for the past 10 years or more an operative procedure for removal of tonsils and adenoids that has been so satisfactory in practically all cases that it may be worth while to add it to the long list of methods now in use.

Under general anæsthesia and by means of the Davis mouth gag, adequate exposure, without which proper surgical procedures are difficult if not impossible, is obtained. This gag when carefully inserted overcomes the objection offered by many and may be so placed that no harm will result to the teeth or soft tissues (Fig. 1). The tonsil is seized with a tenaculum, preferably one with several teeth, rather long, so that when dealing with friable tissues a large amount of their framework may be lightly held within its grasp. The tonsil is then gently drawn upward and toward the midline until the upper end of the line of junction formed by the tonsil on one side and the anterior pillar on the other is brought clearly into view. With a pair of blunt scissors—not with a knife—the mucous membrane of the pillar is divided as closely as possible to the presenting surface of the tonsil. A point of cleavage between the pillar and tonsil is sought and the end of the scissors inserted into this cleavage. By gentle manipulation the scissors are worked into the depths, care being used in their direction to follow the curvature of the capsule of the tonsil and special care not to puncture it.

After the scissors have been introduced sufficiently (Fig. 2), the blades are gently opened, so as to bring about a blunt dissection with the backs of the blades aided by the leverage of the handles and pressure of the opposing blade. In this way the tonsillar artery is definitely outlined from above (Fig. 3). The incision, through the mucous membrane only, is then prolonged downward following the line of junction between the anterior pillar and tonsil to and including the lingual tonsil. Another point of cleavage between the pillar and tonsil is then found below the tonsillar artery, and by blunt dissection similar to that above mentioned this vessel is isolated and exposed from below (Fig. 4). A long Kelly clamp is then applied to the artery before it is divided, with the result that not only is bleeding reduced to a minimum, but also tissue is conserved by avoiding the necessity of dipping the clamp down into it in an effort to catch a telescoped vessel, which may cause destruction of a relatively large amount of tissue and possibly some very important structures. The artery is then divided, the main arterial supply to the tonsil being thereby cut off before the network of veins has been opened. This procedure, in a measure, is analogous to the application of a tourniquet in the amputation of an extremity. The entire line of dissection, clearly in view of the operator, is carried down (Fig. 5) around the lower pole so as to include both the faucial and lingual tonsil. Usually, it is necessary to clamp the small vessels running to the lingual tonsil, but this is not always the case. The lingual tonsil (Fig. 6) is seized with a tenaculum or Ochsner clamp and by folding it upon itself is drawn forward and upward; by blunt dissection a line of cleavage is found at the junction of the tonsil and posterior pillar. The dissection is then continued up the posterior pillar (Fig. 7), and as the upper pole is approached, numerous veins forming a network

come into view. If sufficiently formidable these are clamped before being divided (Fig. 8). The tonsil is removed and ligatures applied. Personally, I have had but little difficulty in placing these ligatures without the use of a needle. I feel that it is better to have a mass of tissue, which may be expected to necrose in the presence of infection, within the grasp of the clamp, and to have the ligature material on the surface rather than extending from the surface into the depths of the tissue. The partly buried ligatures plus rough handling of the tissues may be important factors in the development of metastatic abscess within the thorax.

Not only do I prefer to follow the anterior pillar down before disturbing the posterior, out of respect for the blood supply and proper handling of this important factor, but in addition I have found in the majority of cases that the anterior aspect of the tonsil, unlike the posterior, instead of being more or less constant, is variable. At times it is so irregular that one may find lymphoid tissue apparently continuous with the tonsil bursting, as it were, through its bounds and crawling up over the anterior pillars more especially as the lower poles are approached.

There are cases in which the lines of cleavage are more imaginary than real; cases in which it is difficult to differentiate tissue; cases in which it is easy to leave tiny bits of lymphoid tissue, difficult to discover at the time of operation, but very easily seen a year later. In these difficult cases the method above described has nothing to lose by comparison with any other that I have used, but for me at least is even preferable.

It is impossible to lay too much stress upon the importance of gentle sponging and the avoidance of unnecessary clamping and other damage to tissues of the throat. The throat deserves the application of the principles of surgery as much as any other part of the body and probably needs them a great deal more.

A discussion of methods of removing tonsils would be incomplete, indeed, were it not also to include a few words concerning their next neighbor, the adenoids.

The writer has long since learned that the amount of adenoid tissue capable of being safely removed with an adenoid curette is in most cases only a small percentage of the sum total. He is also convinced that except for mechanical reasons the portion removable with the curette is the least dangerous to health; that from the standpoint of infection and absorption, the most dangerous portion is not the adenoid tissue accessible to the curette, where drainage is more or less efficient, but it is that large amount of adenoid tissue tucked away, so to speak, in the crannies and folds about and even upon the inferior turbinate bone and adjacent structures. This is perhaps the area of adenoid tissue inaccessible to medical applications as well as instruments, in which infection flourishes and in which the pressure, due to swelling, becomes most damaging. In view of these facts one is inclined to feel that the laugh instead of being on the "old doctor" who used his finger nail to remove adenoids, if his finger were reasonably clean, apparently might be on us. It has therefore been my practice to supplement the conventional use of the adenoid curette with my index finger, with which I explore the posterior nasal cavity thoroughly, giving careful attention to the inferior turbinate bone. In my opinion at least, the amount of tissue removed with this finger justifies this safe, dependable, and indispensable aid.

BLOOD TRANSFUSION BY THE DIRECT SYRINGE-CANNULA NEEDLE METHOD; ITS APPLICATION IN MAJOR SURGERY

By ALFRED A. STRAUSS, M.D., F.A.C.S., Chicago
From the Surgical Services of Michael Reese and Chicago Lying-in Hospitals

BLOOD transfusions have been used for many years as a great aid in major surgery. The majority of surgeons, however, have resorted to blood transfusions in major surgical procedures only when the patient is in very serious condition. This view of using this valuable aid only as a last resort is wrong. It should be used more as a prophylactic measure for poor operative risks. For 14 years I have used blood transfusion on the slightest provocation when there was any question about the risk of the patient and usually before operation with the result that a questionable risk was converted into one that was absolutely safe. Most men have used either the citrate method or some form of complicated apparatus or device for transfusion, whereas we have used only a specially devised needle and an ordinary 100 cubic centimeter Luer syringe, transferring the blood directly from donor to recipient.

Blood transfusion has been especially valuable in hæmorrhage of the newborn and in children, especially in hæmorrhage from the intestinal tract, and in the decompositions occurring in infancy, in acute hæmorrhage from ulcers of the stomach and duodenum, in acute and chronic hæmorrhages from the intestinal tract, and in severe hæmorrhage due to injury.

Much has been written about the danger of transfusing too many times at short intervals, but oftentimes when the clinician fails to recognize that the patient has lost 2 or more quarts of blood, the usual transfusion of 600 cubic centimeters is unsatisfactory because it does not replace the quantity of blood lost or restore the original blood pressure. In several cases of ulcer hæmorrhage so profuse that the patient was pulseless, two transfusions were given by two different donors before operation and a third transfusion from a third donor after operation, followed by complete recovery. In another case a man of almost giant stature who was completely exsanguinated was given two transfusions before operation of 800 and 600 cubic centimeters respectively by two different donors, a third transfusion of 600 cubic centimeters after the operation, and within 12 hours a fourth transfusion of 600 cubic centimeters.

Fig. 1. Cannula needle with obturator and perforated shoulder.

Frequently in chronic obstructive jaundice blood transfusion not only increases the blood pressure and decreases the toxicity but also promptly decreases the coagulation time to 2½ or 3 minutes.

Patients with anæmias secondary to chronic ulcers of the stomach and duodenum, chronic ulcerative colitis, carcinoma of the stomach, duodenum, colon, and rectum may be undernourished, emaciated and markedly dehydrated. Such patients are not immediate emergencies for operation. They are prepared for operation in the following manner: For 6 or 8 days they are given one pint of 5 per cent glucose solution twice daily plus 3,000 cubic centimeters of physiologic salt solution once daily, followed by a 600 to 800 cubic centimeter blood transfusion just before operation. If the patient's condition is at all questionable after operation, a second transfusion of about 600 cubic centimeters of blood should be given without hesitation. A patient who has been prepared in this manner or modification thereof will go back to bed from the operating room with a full pulse usually less than 100, with blood pressure ranging from 110 to 130—and if the blood pressure is at first 80 or 90 it is raised to between 110 to 130—with flushed face, red lips, warm extremities, free perspiration, and he will excrete large quantities of urine. He does not develop any secondary shock and usually goes on to an uneventful recovery. On the other hand, a patient on whom operation is carried out without such preparation usually comes back pale, with a pulse of 120 or more, with cold clammy extremities, and gives the surgeon 24 to 72 very anxious hours. The surgeon will then probably utilize all of these methods which should have been used before operation. It is much easier to employ methods before operation to prevent shock than to use these procedures after the operation to treat the shock often without avail.

I always perform blood transfusion when there is the slightest suggestion of an indication for it and with most gratifying results, and I am not

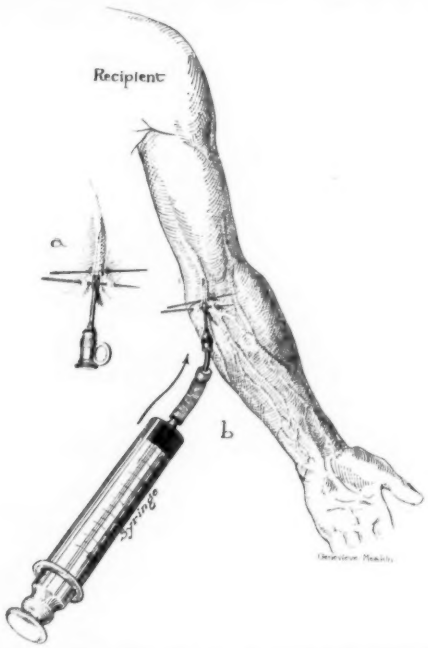


Fig. 2. Recipient's arm, showing transfixion of the skin and upper wall of the vein by one cambric needle, and transfixion of the cannula by a second cambric needle inserted through the perforated shoulder of the cannula.

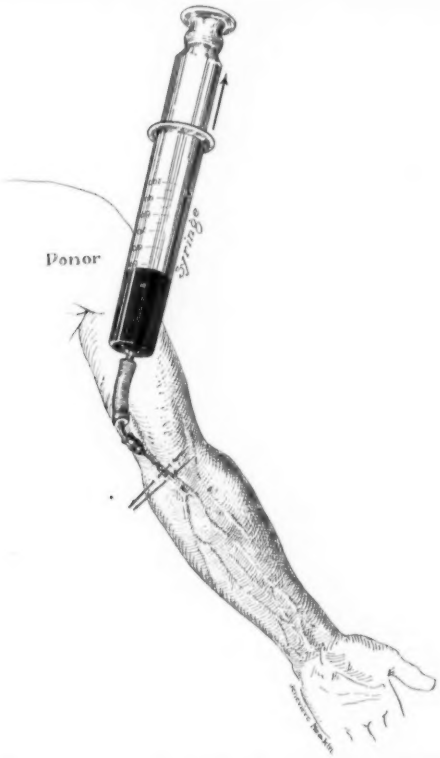


Fig. 3. Donor's arm, showing curved adaptor and glass syringe containing blood.

overestimating its value when I state that it has lowered the mortality from 10 to 15 per cent in such major surgical procedures as complete colectomy, high gastric resection, and resections of the small intestine, especially in the cases of infants and children.

Blood transfusion is of special value in the various anæmias in which splenectomy is indicated. Repeated weekly small transfusions in extensive carcinoma have quite a telling effect, and the question of the carcinolytic action of the blood of young donors is interesting and merits investigation. Repeated small transfusions have saved many lives in the slow, mild, chronic suppurative processes that produce secondary anæmias. My experience has not been very favorable, however, in acute infections and acute septic processes, in which the patient runs a high temperature and rapid pulse, and I have discontinued the use of blood transfusion in these cases, believing that it has been distinctly harmful.

The statements that I have made about the use of blood transfusion in adults hold tenfold for children and infants. In hæmorrhage of the newborn, especially from the gastro-intestinal tract, from 50 to 75 cubic centimeters of blood given through the superior longitudinal sinus will usually stop the bleeding and convert, as if by magic, an apathetic, pallid, stuporous newborn babe into a normal looking child with a lusty cry within 2 minutes. A second transfusion was necessary in only a few out of a large series of these cases. In preparation for operation in congenital pyloric stenosis, when the patient comes to the hospital in a stuporous or semicomatose condition, with very weak and thready radial pulse, I give 150 cubic centimeters of physiologic salt solution under the skin every 3 hours for 24 or 48 hours, plus 1 or 2 intravenous glucose transfusions of from 50 to 75 cubic centimeters and finally 1 or 2 transfusions of 75 cubic centimeters of blood into the superior longitudinal sinus. Here, within 24 or 48 hours a child which was markedly dehydrated and apparently near death is converted into a good operative risk.

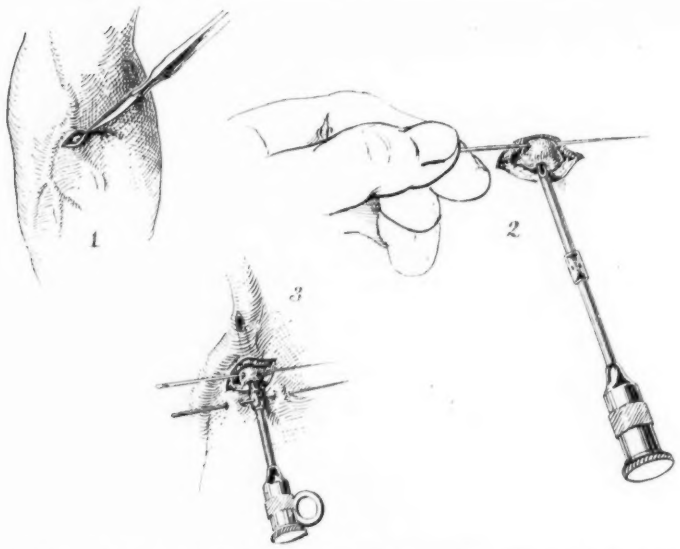


Fig. 4. Method of insertion of cannula needle in case the recipient has low blood pressure or poor veins.

I have used blood transfusion in hæmorrhages from the small intestine when a chronic anæmia has existed from a small local lesion, such as a bleeding Meckel's diverticulum, a polyp, as well as in cases of intussusception and gangrene of the small intestine when extensive bowel resections have to be performed in small children 1 or 2 years of age. The nutritional disturbances associated with diarrhœa in infants and children respond remarkably sometimes to a single transfusion, the child soon gaining in appetite and weight.

The effects of blood transfusion in general are: improvement in blood pressure; an increase of 1,000,000 to 2,000,000 red cells per cubic millimeter and an increase in the white count, hæmoglobin and coagulability of the blood.

It is a well known fact that blood simply exposed to the air will undergo marked chemical changes. I have observed that blood transfusion in anæmias is of greater benefit and has a more lasting effect when the blood is drawn from donor to recipient with little disturbance, and rather quickly so that the temperature of the blood is practically unchanged. The effects are not satisfactory when a reaction and chills occur, as in the citrate method. I believe that the reactions in the citrate method are due more to these factors than to the citrate itself. By the direct syringe-cannula method I have had only about 2 per cent of reactions in a series of about 1,000 transfusions in 14 years. A reaction may occur if the interval in transferring the blood from the donor to the recipient is prolonged, and is probably due to lowered temperature or beginning coagulation.

In order to make the use of transfusion practicable, an institution should have on immediate call a dozen or more young male donors who have been grouped and who have negative Wassermann reactions within 6 weeks of the transfusion. It is necessary also to do a direct compatibility test between the serum of the recipient and the cells of the donor. The same donor should not be used twice on a patient because of the formation of iso-agglutinins. A number of our recipients have changed type after several transfusions.

TECHNIQUE

The apparatus for the direct syringe-cannula needle method consists of three 100 cubic centimeter Luer syringes, which usually hold about 150 cubic centimeters of blood, a short piece of rubber tubing, and two cannula needles, one for the donor and one for the recipient. The cannula needle (Fig. 1) contains an obturator which is beveled at the end like a spinal needle, and is sharp enough to pierce the skin and the vein with ease. Midway down the cannula needle is a shoulder with a perforation of a size to admit a cambric needle.

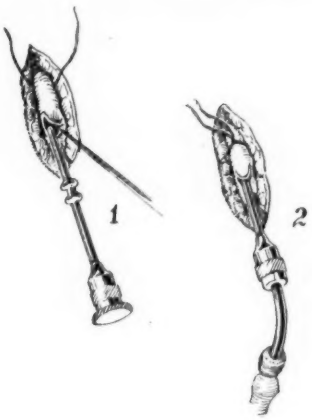


Fig. 5. Method of insertion of cannula needle in the small vein of a child.

The technique of inserting the cannula is as follows: A blood pressure apparatus or small rubber constrictor is set on the recipient's arm and the pressure raised up to 60 or 80 millimeters of mercury. The recipient contracts the muscles of the forearm to distend the vein. A fine cambric needle is inserted transversely to the long axis of the vein, so as to transfix the skin and the upper wall of the vein (Fig. 2, *a* and *b*). This holds the vein solidly against the skin, and the sharp cannula needle is inserted just below the cambric needle through the skin into the vein. The cannula is set proximally in the arm of the recipient, and is transfixed by a second cambric needle which passes through the skin on one side, the perforation in the shoulder of the cannula, and out through the skin on the opposite side (Fig. 2, *a* and *b*). The same technique is used on the donor, except that the cannula is placed distalward. A Luer syringe is washed in saline solution and rinsed in 2 per cent citrate solution, but no citrate is left in the syringe save what may adhere to the walls of the syringe. The obturator is then removed from the cannula in the donor's arm, and the curved adaptor (Fig. 3) with its small piece of rubber tubing and glass syringe is attached to the cannula. When the donor contracts his forearm muscles by opening and closing the hand, the blood is easily drawn up into the syringe. In fact, without any traction whatsoever, the pressure of the blood will force the plunger upward as the blood runs into the syringe. After 100 cubic centimeters or more is drawn up into the syringe, it is detached and transferred to the recipient, while the assistant draws a second

Fig. 6. Method of injecting blood in an infant with open anterior fontanel. Note the metal guard on the cannula needle.

syringeful from the donor. After the syringe has been used, it is again washed in saline solution by the nurse and rinsed in citrate solution. In this way, three 100 cubic centimeter Luer syringes are kept going in rotation, and from 600 to 800 cubic centimeters of blood can easily be transfused in 10 minutes. There is, however, no necessity for haste, as the blood does not coagulate within the syringe for at least 4 or 5 minutes.

Occasionally in a patient whose blood pressure is so low that he is pulseless, or in a woman whose veins are poor, it may be impossible to enter the vein by this method. A very small incision can then be made through the skin transversely to the long axis of the vein, exposing the vein (Fig. 4, *1*) and a cambric needle inserted through the upper wall of the vein (Fig. 4, *2*). The cannula needle is inserted into the vein, being transfixed to the skin by a second cambric needle (Fig. 4, *3*) as in the foregoing method. If this method proves unsuccessful in the recipient on account of smallness of the vein, as in a young child, a short

longitudinal incision is made through the skin, the vein is lifted and a small oblique incision made, through which an ordinary cannula needle is inserted and transfixed with catgut (Fig. 5, *1* and *2*).

In an infant with an open anterior fontanel, a needle with a small metal knob, so placed that the needle will just reach the superior longitudinal sinus but not go through it, is used. The landmark for inserting the needle is the posterior portion of the anterior fontanel where the two parietal bones meet (Fig. 6). The needle is plunged in right up to the metal guard, and if the needle is in the sinus a free flow of blood results. If a free flow of blood does not result, the needle should be placed to one side or other of the original puncture. One must never inject the blood unless there is a free flow of blood from this needle puncture. I have used this simple method of transfusion in infants for many years in a large series of cases without any ill results.

CONCLUSIONS

1. The advantage of this method of blood transfusion is its absolute simplicity and the absence of any unusual devices which always produce coagulation and get out of working order.
2. The donor's as well as the recipient's veins can be used repeatedly without destroying the vein.
3. The donor can be in one room and the recipient in another, no proximity being necessary between donor and recipient.
4. The transfusion can be done with very little assistance. On account of its simplicity it can be carried on at the patient's bedside.
5. Blood transfusion by this direct method without citrate produces practically no reaction.
6. Blood transfusion as a prophylactic measure in patients who are questionable risks for major surgery is of inestimable value in reducing the mortality and should be used more in the future.

RENAL ROENTGENOGRAPHY DURING OPERATION[1]

By MERRILL C. SOSMAN, M.D., Boston, Massachusetts
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THE surgeon's dilemma at the conclusion of an operation for renal stone is obvious. Has he removed all of the particles and fragments or has he left some to act as nuclei in the formation of more stones? Has he damaged the kidney unduly in his effort to free it entirely from calculi? Would it not have been better to have sacrificed the kidney instead of making exploratory transcortical incisions to reach the tips of the calyces? His position is much worse, however, when he fails to find a stone previously shown by the X-rays and localized as accurately as possible as being in the renal pelvis. Furthermore, cases of "recurrent" stones are reported when there is no positive evidence that they are not relicts. One surgeon, Dr. J. D. Barney, has checked up his work by postoperative X-ray examination and finds recognizable particles or fragments remaining in 45 per cent of his cases (1). His article gives an excellent résumé of the difficulties to be met and overcome, which will not be repeated here.

Braasch and Carman were the first to suggest a procedure to meet this dilemma (2, 3), a procedure which has certain objectionable features as applied in various hospitals and clinics throughout the country. They advocated fluoroscopy at the operating table, using a portable machine and an ordinary fluoroscopic screen (provided the operating room could be darkened). The kidney was mobilized and lifted above the "horizon" of the body by gauze strips; all sponges, clips, pads, and instruments were removed; the wound was draped with a sterile sheet or towel; and the fluoroscopist, equipped with a sterile metal pointer, was then called upon to locate the stone.

We have attempted this procedure, using a head fluoroscope (as the operating room could not be darkened) and found it quite unsatisfactory, for reasons which will be explained. The method was therefore modified to permit the use of a film, small enough to be slipped into the operative wound behind and below the exposed kidney, and a radiogram of the kidney was then made, a small portable or "bedside" machine being used. The film is enclosed in a small rubber bag, which has previously been sterilized and dried, to prevent soiling of the operative field. Such a film can be developed, fixed, and returned to the operating room in a few minutes, and the surgeon can see for himself the exact location,

[1] Read before the New England Roentgen Ray Society, November 21, 1924.

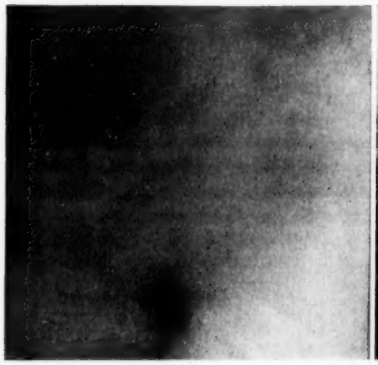

Fig. 1.

Fig. 1. Case 1. Pre-operative film showing large calculus blocking the ureteropelvic junction, and two smaller calculi above it.

Fig. 2, *A*.

Fig. 2, *B*.

Fig. 2. Case 2. Films at operation. *A* shows two large fragments. *B* shows, after their removal, a small collection of "sand." Note the air in the dilated calyces.

size, number, and character of the shadows. This is the first and one of the most important advantages of this method as compared with that of Braasch and Carman. Instead of relying upon verbal descriptions or directions, the surgeon can see at a glance what the condition is and what must be done. It is almost a platitude to state that direct observation by the operator is decidedly more reliable than an indirect and second-hand verbal impression in such a case, but it is obviously true.

The time element is essential in two ways. While very little time is consumed in taking a single peep at the kidney with the fluoroscopic screen, a number of such examinations, repeated at intervals, are required; and therefore the total time consumed is more than that required for the taking of a film. Furthermore, fluoroscopy demands a trained roentgenologist and consumes his time, both in sensitizing his eyes and waiting for the surgeon to mobilize the kidney. With the film technique, an assistant, technician or nurse, can do the work at any moment needed, and the films can be repeated as frequently as is necessary. As regards total time consumed, it was demonstrated at a meeting of the Clinical Congress of Surgeons in October, 1923, at our hospital, that 10 minutes was the maximum time necessary to wheel up the machine, take the film, develop it and return it to the operating room, less time, in fact, than the roentgenologist would use in preparing his retinæ for fluoroscopy.

In fluoroscoping the kidney, there is no protection against the rays except that of the fluoroscopic screen. The surgeon and his assistants are also exposed at times for several minutes (at intervals, of course) while with films only 2 seconds exposure is necessary, and consequently there is very little danger of an X-ray dermatitis. If the operating room is one that cannot be readily darkened, a head fluoroscope must be used, which is even more unsatisfactory and offers practically no protection.

Fluoroscopy is quite unsatisfactory if the kidney cannot be lifted out of the operative wound, but this fact does not in the least interfere with satisfactory films.

As is evident in other branches of our work, there is no comparison between a fluoroscopic impression and a clean-cut film for detail and accuracy, and it would be quite possible to miss small particles of "sand" or large fragments of soft stones (e. g., the uric acid or "negative" calculi) on the screen, which would be well shown on the film.

Finally, the value of a permanent record is evident. It is a question of fact versus opinion, and needs no discussion.

PROCEDURE

The portable X-ray machine is placed in the operating room and tested before the operation begins. A small rubber bag is sterilized and placed on the instrument table. Films 4 by 5 inches in size[1] are kept on hand and when the occasion arises one of these is dropped into the bag, the

[1] Up to the present time we have prepared our own "special" films for this work by bisecting an ordinary 8 by 10 film, rounding the corners, putting each half on a lead-foil backing and wrapping each film in black, then opaque red, paper. This made the package a bit clumsy and valuable space at the edge of the film was lost due to the folded paper.

Recently, a St. Louis firm has been good enough to supply us with special films 4 by 5 inches in size, made up exactly like a lead-backed dental film, which save us considerable time and are much easier to handle.

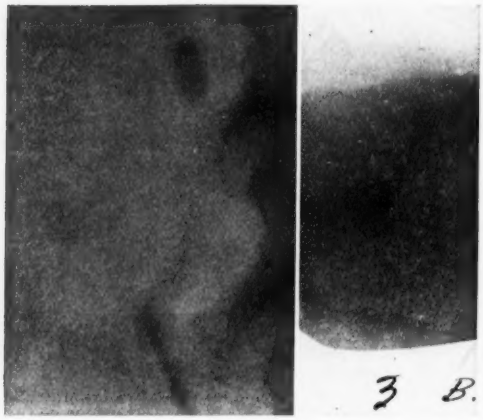

Fig. 3. Case 4. Pre-operative film, *A*, and operative film *B*.

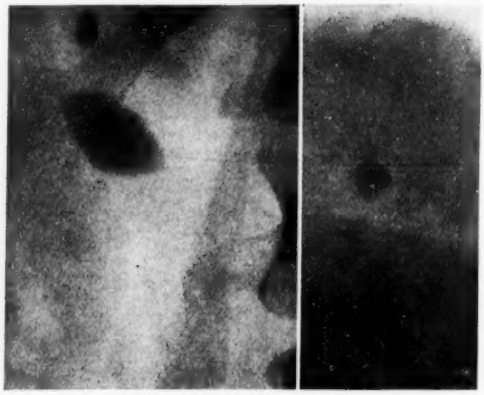

Fig. 4. Pre-operative film, *A* (left), and operative film, *B*. *A* shows a large calculus which was easily removed, but the smaller one eluded careful search. *B* shows it to be in the middle calyx.

open end of which is folded over. This film is then placed under the kidney, the latter being lifted or held by gauze strips or tapes, the machine is wheeled into place and an exposure of 2 to 5 seconds is made, depending on whether the kidney is free or buried. (It is well to overexpose the film so that it will develop quicker.) The film is then developed, fixed, and returned to the operating room or a report may be sent if the kidney is entirely free from stones. As noted above, the whole procedure requires but 10 minutes.

RESULTS

So far 25 cases have been examined. In 3 cases exposures were made to locate shadows thought to be calculi on the pre-operative films and not found at operation. In all 3 the calculi were shown, and were then localized and removed. In the 22 remaining cases, all had had stones removed, and the films were made to rule out the possibility of retained fragments. Four of these showed calculi remaining which were located and removed. A technical failure may be recorded in 1 case, when the surgeon accidentally turned the film so that the lead back was against the kidney. A second case was given up as the kidney could not be mobilized enough to get a film under it, because of aberrant arteries. All of the renal arteries entered at the upper and lower poles so that it was impossible to do even a pyelotomy. This case could hardly be counted as a failure, as the operation had to be abandoned on account of the congenital anomaly.

So far not one of these patients has returned with a "recurrent" stone.

The value of this procedure can best be illustrated by the following selected cases from the Urological Service of this hospital. Dr. William C. Quinby has been good enough to verify them and at the same time express his appreciation of the help which this method gives him. He has informally described this procedure previously (6, 7). These cases have been encountered in the past 2 years, during which time the procedure described has been practically routine in all pyelotomies and nephrotomies for calculi.

CASE 1. (33890, Fig. 1.) Pre-operative films showed a triangular stone with two smaller ones above it. A pyelogram showed the larger stone blocking the ureteropelvic junction. At operation the removal of the larger stone was followed by a gush of urine in which one of the smaller stones was found. The other could not be located in the gauze around the wound, or in the kidney. A film made at this point showed the kidney to be entirely free of calculi, thus saving the patient an exploratory incision through the cortex. Both calculi must have been carried out when the large stone was removed and the dammed up urine released.

CASE 2. (31737, Fig. 2.) This patient had passed crystals and small calculi at intervals since the age of 12. Six years ago he had a bladder calculus removed, the X-ray at that time showing bilateral renal calculi, but further operation was refused. He finally came to this hospital because of severe pain in the left flank. The X-ray films here showed bilateral calculi, much less dense than normal, which appeared in the pyelogram as "negative" shadows.

At operation, calculi were removed from a dilated lower calyx, the pelvis, and the ureter, and a large amount of sandy material was washed out. Three kidney films were taken, the first showing several large fragments, the second only two small ones, and the third only a pocket of "sand" which was washed out.

It is interesting to note that these were cystin stones as were the bladder calculi and the crystals

which he passed from time to time. Several members of the patient's family showed cystinuria and cystin calculi. Furthermore the shadows were positive on plain plates and the special kidney films, but less dense than the iodide used in pyelography (12.5 per cent) appearing there as "negative" shadows (4). A similar case has been previously reported (5).

CASE 3. (31163.) The first operation, at another hospital (appendectomy, no relief) was done in 1921. A second operation was done (1922) after plain films and pyelograms identified a large right renal calculus, which was removed. No film was taken during the operation. The third operation was 18 months later at this hospital after a "recurrent" calculus had been located. This was easily removed through a pyelotomy incision. Palpation revealed a small hard area in the upper calyx which was thought to be a smaller stone imbedded in the calyx. A renal film showed the kidney entirely free of calculi, again saving an exploratory incision through the cortex. The calculus removed here was rather large to have been formed in such a short time and it is probable that this was a case of residual stone rather than a recurrence.

CASE 4. (12625, Fig. 3.) This patient had typical renal colic. The X-rays showed a small stone supposedly in the kidney. Operation (May, 1919) failed to reveal the stone after a thorough and careful search. Symptoms continued.

A second operation was performed after careful examination, films, pyelograms, etc., had made us feel sure that there was a small calculus (the same one previously seen) in the kidney. Exploration again failed to reveal the stone. In spite of difficulty in mobilizing the kidney (due to adhesions following the first operation) a satisfactory film was obtained during the operation, locating and identifying the stone, which was then removed through a cortical incision.

The difficulty in this case was probably due to an abnormal intrarenal pelvis preventing satisfactory palpation at either operation.

CASE 5. (32819.) Pre-operative films showed one shadow. At operation, one stone was removed corresponding to the shadow. The renal film showed another calculus deep in the kidney and some sandy or grumous material not shown on the first films. These were removed from the middle calyx by a transcortical incision.

CASE 6. (28327.) Films (pre-operative) showed bilateral renal calculi and a right ureteral calculus. The patient refused immediate operation but returned 8 months later. As the function on the right was better than on the left and less infection was present, a decision was made to free the right kidney. Accordingly, a large stone was removed from the right renal pelvis and then a smaller one which was not previously seen or felt was located by a renal film and removed. The ureter was then freed and opened, but no stone was obtained. Because it was thought that the stone had been forced into the bladder, a cystotomy was done but no calculus was found. Our conclusion was that that particular stone had been passed during an attack without the patient's knowledge.

The value of the "renal" film here is secondary to the consideration that only quite recent films should be depended upon when the calculus is small enough to move or be passed, an obvious platitude but too often disregarded.

These cases illustrate the various uses to which this procedure may be put, as well as incidental points of considerable importance such as may arise at any time.

CONCLUSIONS

1. Roentgenography of the kidney exposed at the operating table is shown to be practical as well as practicable, and of great importance in operations for renal calculi.
2. Its advantages over fluoroscopy under the same conditions are discussed.
3. Illustrative cases are presented.

REFERENCES

1. BARNEY, J. D. The question of recurrent renal calculi. Surg., Gynec. & Obst., 1922, xxxv, 743–748.
2. BRAASCH, W. F., and CARMAN, R. D. Renal fluoroscopy at the operating table. J. Am. M. Ass., 1919, lxxiii, 1751–1752.
3. Idem. Renal fluoroscopy, etc. Radiology, 1924, ii, 222–226.
4. GRAVES, R. C. Shadowless renal calculi. Ann. Surg., 1922, lxxv, 487–491.
5. LOONEY, J. M., BERGLUND, H., and GRAVES, R. C. A study of cystinuria. J. Biol. Chem., 1923, lvii, No. 2.
6. QUINBY, W. C. Remarks on the operative localization of urinary calculi. Boston M. & S. J., 1924, cxci, 194–197.
7. Idem. Note on localization of renal calculi, etc. Tr. Am. Ass. Genito-Urin. Surg., 1924, xvii, 199–200.

A SIMPLE METHOD OF DETERMINING PATENCY OF FALLOPIAN TUBES

By SAUL SEIDES, M.D., New York
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SINCE the publication of Rubin's classical method of transuterine insufflation the test for patency of the fallopian tubes has become a frequent procedure in the practice of gynecology. It is natural, therefore, to find that gynecologists are putting forth every effort to simplify the technique of the Rubin test and to make the apparatus less cumbersome so that it can be more readily used in the daily office practice.

Recently several articles dealing with the subject of the simplification of the Rubin test have appeared by Furniss, Dickerson, Jacoby, and others.

The following is a description of a contrivance I have successfully employed since Dr. Furniss, in 1921, suggested the use of air instead of oxygen for testing tubal patency.

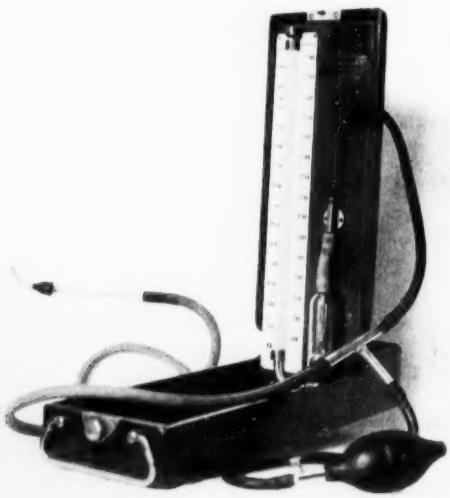

Fig. 1. Photograph of instrument assembled for use.

Possessing a sphygmomanometer, one requires only a uterine cannula, a T tube, and some rubber tubing to complete the outfit. The blood pressure cuff is detached from the sphygmomanometer, and the T tube and cannula assembly connected with it. The bulb is worked in the same manner as when one takes the blood pressure. After the cannula is introduced into the cervix and properly adjusted, the bulb is compressed very gently so that the pressure rises only 5 to 10 points with each compression. After each compression of the bulb the operator pauses a moment to note the rise of the mercury. When the pressure reaches a height sufficient to open the tube (in patent cases) and cause the escape of air into the peritoneal cavity, the mercury begins to drop, and continues to drop, until the pressure becomes equal to the resistance offered by the tube. At that point the mercury remains stationary. The bulb is now compressed again, driving the mercury up from 10 to 20 points. When the bulb is released the mercury falls rapidly to its former height or a little lower. Another compression of the bulb causes a repetition of the previous occurrence. We are now confident that the patency of a fallopian tube has been established. Although the first characteristic drop of the mercury is manifest evidence that the tube is open the two additional compressions of the bulb serve the purpose of introducing sufficient air into the peritoneal cavity to elicit the shoulder pain as confirmatory evidence of tubal patency.

So small is the amount of air introduced by this method that the shoulder pain does not appear until after the patient has been up and about for several minutes. This pain, though definite and unmistakable, is so mild that, as a rule, it does not interfere with the patient's customary activities, and disappears entirely within 24 hours.

It is understood that the cases thus tested are carefully examined to exclude conditions that contra-indicate insufflation, and that strict asepsis is practiced throughout the procedure.

A BODY REST FOR MAINTAINING PATIENTS IN PRONE POSITION FOLLOWING INTRACRANIAL OPERATIONS

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From the Department of Neurosurgery, Hospital of the University of Pennsylvania

IN the practice of neurosurgery it has frequently been found advisable to treat patients, many times semi-conscious or stuporous, by placing them in the prone position (face down) and often with the feet elevated. This procedure is especially useful in the postoperative treatment of patients who have had suboccipital craniotomies, plastic operations for posterior meningocele, and in high cervical laminectomies.

The prone position with feet elevated has been found most useful, also, in the treatment of cases of intracranial trauma, and after operations on the brain, when the slowing of the pulse and respiration with a rising blood pressure suggest medullary pressure. In these circumstances placing the patient face down, with the foot of the bed elevated about 4 feet, has been found effective in tiding the patient over until the cerebral œdema is reduced in the postoperative cases, or until operative intervention can be undertaken in the cases of cranial trauma.

In order to allow for breathing space and to hold the head in a constant position, we bolstered the patient with pillows under his chest and head. The disadvantages of this method were that the patient was continually sliding to one side or the other, and when the foot of the bed was elevated, he was constantly approaching, and often reached, the head of the bed.

Fig. 1. Body rest in use with patient and foot of bed elevated.

We have, therefore, devised a triangular box, well padded on the top, which is slipped under the chest of the patient, lifting his shoulders about 5 inches from the bed. It is made with shoulder pieces of well padded steel which fit on either side

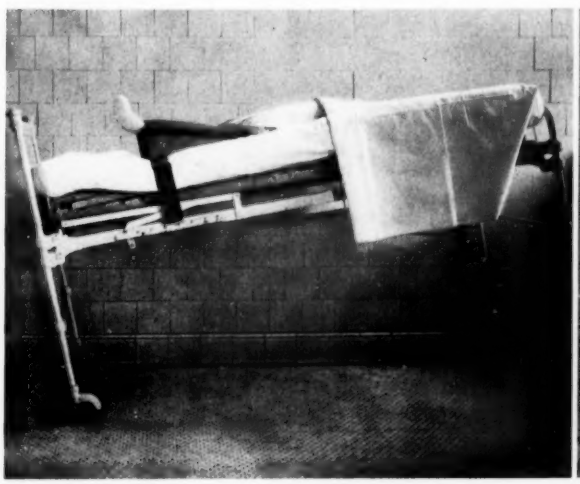

Fig. 2. Lateral view showing foot of bed elevated and body rest in place.

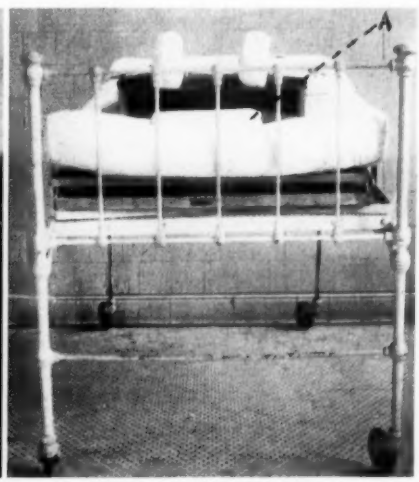

Fig. 3. Front view showing folded sheet, *a*, to support patient's head.

of the neck to support the weight of the patient when the feet are elevated. To prevent the patient from slipping downward when the foot of the bed is raised, small cleats were fastened to the bottom of the box which catch beneath a steel cross piece made just wide enough to fit across a hospital bed and bent down over the sides. The cross piece may be tied or clamped to the bed frame if necessary, but we have found that its rather sharp edge digging into the mattress will hold a very heavy patient in position with feet elevated without clamps. The head is easily supported on a folded towel or sheet, making plenty of room for breathing space.

The device has proved most useful in our hands, and we find that the nurses are most grateful for its use because it lightens their duties considerably; the patient is easily maintained in position, and he can be easily cared for when he vomits, drinks, etc., and most important, the patients themselves are held for days in this position with a reasonable degree of comfort.

CORRESPONDENCE

BASIC PRINCIPLES AND SUPREME DIFFICULTIES IN GASTRIC SURGERY

To the Editor: In my article entitled "Basic Principles and Supreme Difficulties in Gastric Surgery," which appeared in the January, 1925, issue of SURGERY, GYNECOLOGY AND OBSTETRICS, an error has been made in that subgroups (a) and (b) are interchanged. On page 2, right column, the sixth line from the bottom should read: "Subgroup (b) would then correspond to an increased function of the sympathetic and to the condition often found associated with gastric ulcer, and subgroup (a) would correspond to a diminished function of the sympathetic or an overacting vagus, and to the pathology associated with duodenal ulcer."

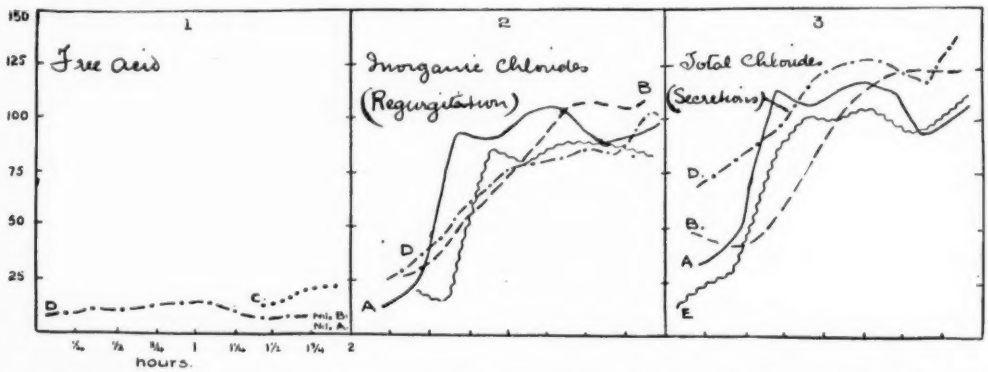

Fig. B. A series of charts illustrating a comparison of curves of successful gastro-enterostomy. *A*, Successful gastro-enterostomy; *B*, partial gastric exclusion; *C*, partial gastrectomy for duodenal ulcer; *D*, modified Pólya operation for duodenal ulcer; *E*, partial gastrectomy for gastric ulcer.

We are publishing herewith a corrected chart for Figure B which appeared on page 11 of this article.

H. B. DEVINE, M.S.

Melbourne, Australia

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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NOVEMBER, 1925

SURGICAL PATHOLOGY AND THE YOUNG SURGEON

THAT an adequate knowledge of surgical pathology is absolutely essential for every well trained surgeon is beyond question, but at present only a small percentage of operators meet this requirement. For us older members of the surgical profession it might be urged in extenuation that at the time of our graduation, even in many of the good schools, the teaching of pathology in general was somewhat inadequate. For the younger surgeon, however, there is no excuse whatever, and it is high time that steps should be taken to rectify this defect.

It would be a great comfort to the operator to have a general pathologist on hand at all times to advise him in obscure cases; but we are living in a practical world. As a matter of fact, there are hardly enough professors of pathology to man the teaching schools, and such being the case, the pathologist has no time to stand around in the operating room hour after hour in case his advice may possibly be needed. He is too valuable a man to dissipate his energies in such a manner. On the other hand, since it is absolutely essential that a pathologist be present at every important operation, it necessarily follows that this pathologist must be the surgeon himself.

The operator who has a thorough knowledge of gross surgical pathology in the majority of cases is able at a glance to diagnose the exact condition when the abdomen is opened, so that he can decide intelligently whether to go ahead or to back out. In cases of obscurity a piece of the puzzling tissue is excised, a technician makes frozen sections and, as a rule, after a glance through the microscope, the surgeon can at once reach a diagnosis. As a result, he can go right ahead with his routine work without being dependent on the hour at which the pathologist can be on hand, and at the same time the latter is relieved of an unnecessary and time-consuming routine. Only in the very doubtful cases need he be called upon to render the final judgment.

This knowledge of surgical pathology by the surgeon then, not only saves a great deal of time but also makes the practice of surgery infinitely more fascinating, as the operator himself is able to get down to the rock bottom facts about his cases. In his routine work he will often encounter some rare condition, a lesion which without his knowledge of pathology might mean nothing to him but which at a glance he recognizes as a rarity, studies carefully and in due time adds to the literature. It is this close correlation of the clinical picture with the laboratory findings that gives the best results.

At the present day the remedy for this crying defect is in the hands of the surgical profession. In the leading clinics of the country are well manned laboratories of surgical path-

ology, whose doors are wide open for seekers after knowledge.

There are many wide awake young internes who are anxious to become surgeons and who are applying to the various surgical clinics for assistantships in surgery. Some applicants measure up, others do not. A premium should be placed on a knowledge of surgical pathology. When a suitable applicant appears, he should be told that he will be accepted after he has taken at least a year in the surgical pathology of his special branch, in one of the leading clinics. After the candidate has done this and has returned, bringing with him a certificate from the Director of the Laboratory to the effect that he has taken the prescribed course and that he has a comprehensive knowledge of the surgical pathology of his particular branch, his appointment as assistant in surgery can be duly consummated.

If this policy is adopted by all surgical clinics, almost before a decade has elapsed, practically all the oncoming surgeons will have a thorough knowledge of surgical pathology, and once having gained this fundamental knowledge, they in turn will see to it that their assistants have a similar training.

THOMAS C. CULLEN.

THE TREATMENT OF FRACTURES

THE aim of all therapy is to expedite complete recovery of function. It is attained when procedures are in harmony with the natural processes which develop powers of resistance and defense, growth and repair. Thus alone can temporary disturbances of function be restricted and the earliest restoration to normal be assured. A survey of fracture therapy from this viewpoint indicates defects and suggests remedies.

Modern practice is based upon original dogmas promulgated when physiology was mythical and the nature of repair was unknown. Healing of broken bones, we are taught, requires that fragments be reapposed, that the reapposition be maintained and that it be continued with immobilization until firm osseous reunion has occurred. Knowledge of the influence exerted by these procedures upon natural processes of repair is essential to progress.

Organisms, the organs and tissues forming organisms, and the cells of tissues and organs require exercise and nourishment to be healthy. Atrophy follows inactivity. Atrophy is inevitable with starvation. Inactivity and hypoæmia are concomitants. Atrophic cells, tissues, organs, and organisms are deficient in powers of resistance and defense, of growth and repair.

Allison and Brooks (Surg., Gynec. & Obst., 1921, xxxiii, 250; Ann. Surg., 1922, v, 499) showed bone atrophy to occur with non-use whatever the cause of inactivation. The extent of the atrophy is commensurate with the degree and duration of inactivation. Atrophy is demonstrable radiographically and is most notable in reductions in density of the cortex and those more compact portions of the cancellated structures which together bear the normal stresses.

Atrophic bone differs from normal bone quantitatively. There is less bone within its periphery. It is more pliable or more fragile and bends or breaks when subjected to less stress. Atrophic bone, unless the atrophy has progressed to osteoporosis, can regain its normal structure through reactivation provided the burdens imposed are within the limits of its strength. Atrophic bone is hypoæmic. It cannot respond to irritations as effectively as normal bone, and its capacity to produce callus is correspondingly restricted. Normal growth is retarded by atrophy and premature ossification of epiphyses is fostered. The therapeutic signifi-

cance of these facts is clear. Immobilization, unfavorable to growth and repair, is contraindicated when avoidable. It is particularly undesirable in treating bone lesions in children. The extent of atrophy caused by immobilization can be measured nicely with radiograms. The reactivation needed to correct the atrophy is to be regulated so that intolerable burdens are not imposed. Exercise, interrupted as little as possible, must be moderately increased until competence is restored.

Callus is comparable to atrophic bone. Immature callus has a subnormal amount of bone within its periphery so it also bends and breaks with less stress than normal bone. Callus matures with exercise in much the same way that atrophic bone regains its natural structure. It becomes more compact and thicker along lines of stress. Other portions, subjected to little or no strains, undergo atrophy of non-use. These changes are recognizable in radiograms. Another therapeutic aid is provided. Callus is competent to assume full physiological obligations when the increased densities along lines of stress indicate its maturity.

The formation of callus is provoked through the irritations caused by fracture. It connects and fixes fragments and replaces defects. The less the irritation and the less the displacement of fragments, the less the amount of callus initially formed. The earlier callus is subjected to tolerable stresses, the sooner it matures; the unexercised superfluous portions atrophy more promptly and the total production is minimized. Osseous repair *per se* is therefore favored by one constant factor, activity.

Patients suffering fractures are unconcerned about the details of bone healing; they are greatly concerned about recovery of function. The functions of bone most affected by fractures are its contributions to active motion. Recovery after fracture is as complete as is the restoration of active motion and health. Consequently the immobilizations imposed should not exceed the requirements surgical experience has found to hasten repair, viz., approximation of like structures with just enough fixation to eliminate excess irritation and to maintain apposition without avoidable restriction in local and general activities.

Nature and clinical experience (Ann. Surg., 1925, October, p. 617) prove the value of reducing immobilization to the lowest requirements for safety. They have demonstrated that reappositions of fragments need not always be exact to permit of healing with complete functional recovery and that aids to maintain reappositions can be superfluous even in fractures of long bones. Nature and experience have proved that active motion is a constant factor in recoveries from all fractures. Active motion can lead to more accurate reappositions of fragments after some fractures of bones in hands, feet, and pelvis for example than can be obtained by manipulation.

The conditions determined by man (reapposition, fixation, and immobilization) to be fulfilled in treating fractures can all be ignored at times and yet functional recoveries may be perfect. The condition found by Nature (active motion) to propitiate bone healing can never be neglected and functional recovery be attained. Reapposition, fixation, and immobilization are needed in treating some fractures. The need has been overestimated. Active motion is needed in treating all fractures. The need has been underestimated. Progress will be made as rapidly as experience determines how little assistance Nature must have to effect satisfactory repair of each fracture.

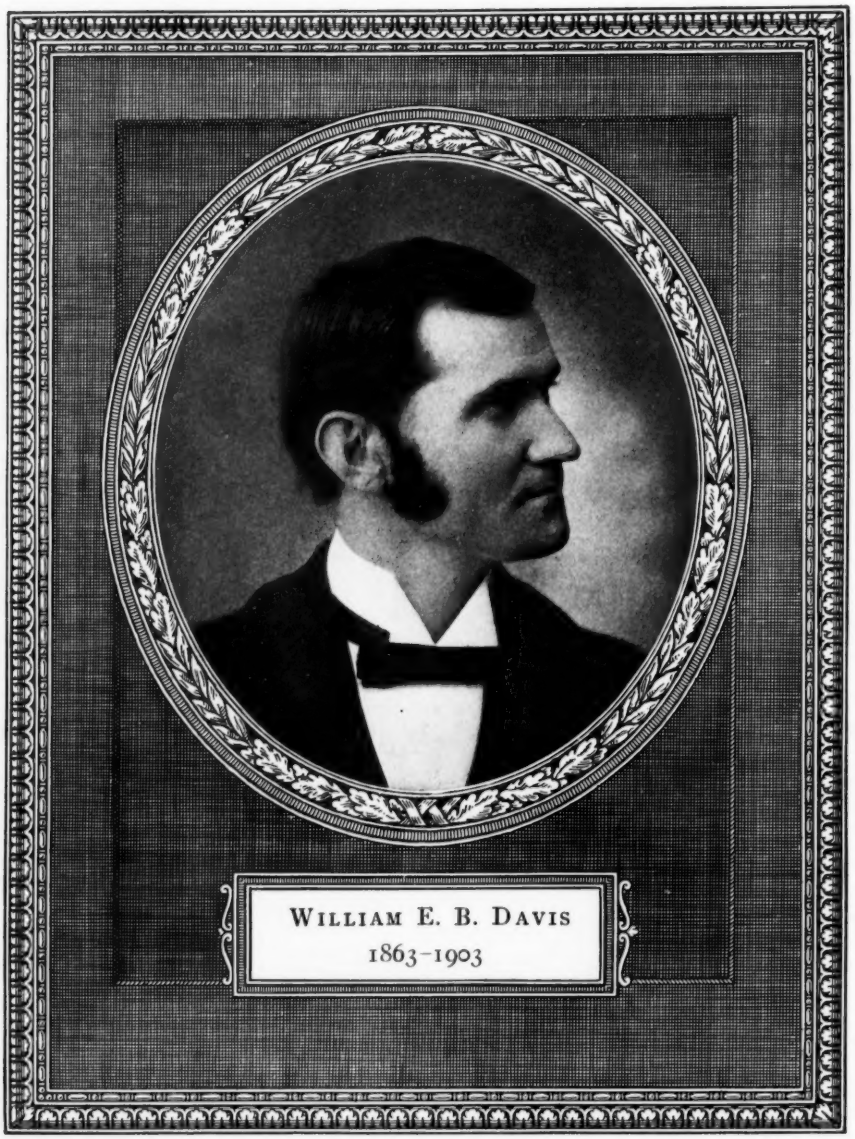
The immediate and remote disability due to fractures is greater than the nature of the lesions warrants. Reductions in fracture disabilities have not equaled the reductions in disabilities from other injuries treated surgically. Appreciation of the economic losses to individuals and to industry resulting from fractures is the cause of growing dissatisfaction with modern fracture therapy. An analysis of reasons for present conditions is illuminating.

Fractures are just as important today as when they constituted the major portion of surgical practice. General surgeons have become more interested in other fields. Treatment of fractures has been delegated to orthopedists, particularly in the larger and more authoritative institutions. The majority of clinicians have not appreciated the superiority of biology to precedent as a basis for therapy. Methods and results have been overemphasized. Rationale has been neglected. Attention has been focused upon technique particularly by specialists. The procedures devised by orthopedists for use in the treatment of fractures have been many and valuable. They deserve little criticism and much credit.

The criticism, if any may be made, is of medical education. The old plaint that the basic sciences are not taught so as to establish their practical aspects is still the excuse. The real reason is that those engaged in clinical teaching are neither prepared nor compelled to develop and to utilize biological sciences in preaching and practice. It is somewhat humorous to realize that the gap between the scientific and clinical departments, which so many philosophers have attempted to bridge, will be closed by economic pressure for more effective therapy.

An immediate remedy suggests itself. Surgical divisions in medical schools are composed of independent departments under various specialists. Their efforts want coordination. Teaching lacks harmony. Students are bewildered by contradictory statements. Basic principles are not established and emphasized so that their constant applicability is recognized. Teaching and practice would benefit if the professors of general surgery were more actively interested in surgical specialties and if surgical specialists were in closer affiliation with general surgery.

J. L. YATES.



WILLIAM E. B. DAVIS
1863–1903

MASTER SURGEONS OF AMERICA

WILLIAM ELIAS BROWNLEE DAVIS

WILLIAM ELIAS BROWNLEE DAVIS, great original investigator, teacher, organizer, leader, and surgeon, was one of the South's greatest contributions to the advancement of medicine and surgery. He was a man of rare charm, culture, and skill. On any occasion he would instinctively attract attention as a man of pleasing and commanding appearance, and as one whose knowledge entitled him to recognition and leadership. His ancestors were for several generations physicians. His grandfather, Daniel Davis, was one of the early settlers of Alabama. His father, Elias Davis, a distinguished officer of the Army of the Confederacy, was killed while commanding sharpshooters at Petersburg, Virginia, leaving a young widow and two sons, J. D. S. Davis, age five, and William Elias B. Davis, age one. The death of the father and the devastation of the war left the heroic mother in most adverse circumstances. Land she had, but no means to cultivate it. The whole space allotted to this sketch could justly and profitably be given to relating the early struggles of these two brothers and their mother which enabled the sons to become pioneers and leaders in surgery.

Elias Davis recognized no bounds in his search for knowledge. This was his life work, to secure knowledge and truth and to develop himself into the most useful, generous, and serviceable human being that it was possible for an aspiring mind to become. His early education was secured in the community school at Trussville, Alabama, and later at the University of Alabama. He studied medicine at Vanderbilt University, the University of Louisville, and Bellevue Medical College, New York, graduating in 1884. He immediately associated himself with his brother, Dr. J. D. S. Davis, in Birmingham, Alabama.

In 1887 Dr. Davis visited foreign clinics, and did special work in England and Germany. He spent quite a time with Sir Lawson Tate in Birmingham, England, after which he returned to his duties and association with his brother in Birmingham, Alabama. "Thus was initiated a career, marvelous in its brilliancy, glorious in its achievements, and utterly sad in its sudden ending" by a railroad crossing accident in which Dr. Davis was killed February 24, 1903.

Dr. Davis needed not the eloquence of an Osler to teach him the master word in surgery; work he had always done, work of a masterful kind he was destined

to do. On returning to his practice he improved every available moment. By close observation, experimentation, and diligent research—amid inconceivable difficulties—he pursued his own original investigations. He perfected his operative technique by work on cadavers, and proved his technique by operations on dogs. This he did throughout his professional career. An operation that he conceived as being possible and serviceable to the human being was established as being such by an original operation on dogs before he adopted it as a safe procedure in his surgical work. Dr. Davis never grew weary in his study, investigation, and discussion of operative technique. He was often dramatic in emphasizing the absolute essentials in successful operative work. Among these were: asepsis and antisepsis, the proper incision, use of retractors, abdominal packs, least trauma to tissue and viscera, identifying structures—the normal and the abnormal, the safest operative procedure, the intestinal anastomosis that was aseptic if possible, did not leak, with good blood supply and a large or adequate lumen; drainage or not, and if drainage, the proper method and material to be used; the doing of that which should be done, and the removal of that which should be removed and nothing more, leaving no necrotic tissue, and no normal tissue with the blood supply destroyed. He regarded the pre-operative preparation of the patient, the operation, and the postoperative treatment with a suitable period of convalescence, as being a part of the operation. He considered that possibly the greatest lessons were learned in the autopsy room. It was there that the hopeless effort, or possibly an error in diagnosis, or defective technique, would be indelibly impressed on the mind. He was not satisfied in case of a surgical mortality unless he could know by an autopsy that he had done everything possible to prevent it. If his diagnosis was wrong or his technique at fault, he considered it of the greatest importance to his surgical progress that he know the real truth as revealed by the autopsy.

In 1892 he experimented upon 200 dogs for the purpose of determining the safest treatment of common duct obstruction. The principles established by his conclusions are that sterile bile is inoffensive to the peritoneum; that after removal of calculi from the common duct, suture of the duct is unnecessary, and indeed, harmful. These observations of Dr. Davis have lessened the dangers and simplified the technique of choledochotomy. It is gratifying to note that all surgeons in this country accord to Dr. Davis full credit for this distinct advance in this field of surgery.

Dr. William J. Mayo says: "Dr. Davis' original experimental and clinical work on the infection of the common duct, one of his many notable contributions to surgical literature, gave him an international reputation."

Recognizing the educational value of medical associations, he allied himself at the beginning of his career with the principal general and special medical and surgical societies of this country. He and his brother recognized the need of a

special surgical and gynæcic society and organized the Alabama Surgical and Gynecological Society. At this time he conceived the possibility of an organization of wider scope. To the accomplishment of this purpose he bent all of the energies of his enthusiastic nature, and as the result the Southern Surgical and Gynecological Association, now the Southern Surgical Association, was organized in 1888. Dr. W. E. B. Davis was elected secretary and active executive officer. His conception of the usefulness and possibilities of such a society was grand in its comprehensiveness. By personal appeals, by tireless correspondence, and by frequent public addresses, he elicited the co-operation of surgeons of the entire country.

Dr. L. G. Woodson, in the welcome address to the Southern Surgical and Gynecological Association, when the statute of Dr. Davis was unveiled, said: "This magnificent association is a greater and more lasting monument to the memory of William Elias Brownlee Davis than the statue of bronze which you will tomorrow unveil. The old aphorism, 'A man is not without honor save in his own country' does not apply to our distinguished dead. He did not have to seek fame and fortune in a foreign land; but in this city, within a stone's throw of the place of his birth, we find him stepping, almost without an interval, from comparative obscurity to the most honored and exalted positions which the greatest and most scientific of all professions could bestow."

Success attended every undertaking of Dr. Davis. He had been active in the medical councils of his state and the nation for more than fifteen years. In 1887, at the age of 24, he was president of the Tri-State Medical Association of Alabama, Georgia, and Tennessee (now Southern Medical Association); in 1893, age 30, he was chairman of the surgical section on abdominal surgery and gynecology in the first Pan-American Medical Congress, vice-president of the second Congress, and vice-president of the American Medical Association and chairman of the section of obstetrics and gynecology; in 1900, president of the American Association of Obstetricians and Gynecologists; and in 1901 president of the Southern Surgical and Gynecological Association. He was honorary fellow of the state societies of New York, Louisiana, and of the British Gynecological Society. A man so conspicuously and constantly in the foreground of his profession must possess unusual traits of character and transcendent elements of success.

The intense interest of Dr. Davis in medicine and surgery, his great interest in young men, and his indomitable spirit as a teacher, caused him and his brother, and a group of learned and distinguished members of the medical profession, to organize in the City of Birmingham a medical college in 1894, now a part of the University of Alabama. The reputation of Dr. Davis as a great surgeon of national and international reputation and the reputation of the able and distinguished men who were associated with him, caused young men to come to the institution in which he taught abdominal surgery and gynecology. These young

men imbibed the spirit of the great teacher, and many of them are today distinguished surgeons throughout the South and other sections of the country. It is not too much to say that the influence of Elias Davis on the lives of these young men caused them to grasp a vision—the possibilities of the highest attainments and the greatest service in the cause of humanity. These men today sing the praise of their ideal man and surgeon, Elias Davis, and of his lasting influence on their lives.

Under the guidance of his mother, Dr. Davis had been trained and brought up in the Baptist church. No man was more devout in his worship and sincere in his belief in the Almighty as the source of all life, all blessings, and true happiness. Surely this is a wholesome lesson in this day of argument as to how man came into existence and his destiny. In the state and county medical societies and his public addresses he never failed to emphasize the importance of the prevention of disease. He gave individual communion cups to his own church years before his untimely death. In this way he taught a lesson and set the example for all Baptist churches. This is but an example of his interest in the public health, and his method of accomplishing what he knew to be right and proper. While he stood fearlessly for what he knew was right, in the presence of opposition, he acted with such consideration for others as to command their respect and esteem.

While Dr. Davis was unsurpassed as a southern gentleman of rare attainments and greatly beloved and highly honored by the profession and the people of the South, and while he never lost an opportunity to praise the southern people and to point out the shining lights among her great men in the various professions and vocations whose names and achievements he revered and honored, and while he was devoted to every sentiment and principle which were held dear to the people of the South, his great mind was national and international. For him, our profession knew no sectional limitations or national boundaries. His mind was so brilliant and his purposes so lofty and pursued with an enthusiasm and energy so untiring as to attract the humble and the great to him. These friends respected, admired, and loved him for his attainments, his nobility of character and his great unselfish services in the interest of humanity and the advancement of science and surgery. The prevention of disease, the cure of disease, the amelioration of suffering, and the application of scientific facts in surgical procedure were to him the very essence of joy and happiness. Life, to him, was synonymous with service and achievement. He was happy in the thought that through his efforts some one might be made stronger and better, and that life itself might be saved and prolonged. He was one of God's noblemen whose presence inspired confidence and trust. The fragrance and influence of his life now live in his native community, city, state, and, indeed, throughout the Southland. His achievements and teachings in surgery are recognized by the greatest surgeons.

Dr. Davis married Miss Gertrude Mustin in 1898. Mrs. Davis still lives in Birmingham. Two lovely daughters blessed this union. They are Mrs. Edward Day Harris of Birmingham and Mrs. David Batchelder who resides in Chicago.

William Elias Brownlee Davis, the master surgeon, was a great exemplar of truth, righteousness, and service. He lives in the lives of thousands who knew him and loved him and through them his life principles will be perpetuated throughout eternity. What he wrought cannot be destroyed by time. Truly to have lived such a life, and to have wrought as he did, though the span of his years was less than forty, should be sufficient, and equal to all requirements of God and man, and should satisfy the aspirations of the noblest soul. E. P. HOGAN.

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

By ALFRED J. BROWN, M.D., F.A.C.S., Omaha

THE SURGERY OF JEAN TAGAULT[1]

IT is natural and to be expected at the inception of a science and scientific teaching, in which category surgery during the sixteenth century might properly be classified, that the practitioners and students of that science would fall into two classes. The first, those in actual practice, the field workers so to speak, who would act as the pioneers of new thought and method and do much toward furthering the budding art of surgery. To this class belonged such men as Paré, Tagliacocci and Clowes—men for the most part of a lesser education than others but intensely interested in the practical side of their work. The second group consisted of men who were well educated and who were interested more in fostering and teaching surgery than in its actual practice. To them, naturally, the works of the older authors appealed and one of their aims was to place this work in an assimilable form for their students, who were of the educated class. These men had little use for men of the clinical and practical type, most of whom had sprung from the rank and file of the lower classes and were essentially not educated men. Consequently their works were written in Latin rather than in the vernacular. This to them appeared to be a method of keeping surgery on a high plane. These two classes of surgeons both considered themselves true scientists and rightly so, but were constantly endeavoring each to belittle the other. Consequently this period shows a sort of three fold enmity for the practical class was constantly endeavoring by word and deed to get after the itinerant surgeon who was in the majority of cases an out and out quack, while he himself was under fire from the savants. So he, who was really doing the greatest work for his science, found himself, as it were, between the upper and the nether millstones.

Jean Tagault (Joannes Tagaultius Ambianus Viniacus) belonged to the class of the savants and highly educated men. Born in Vimeu in Picardy, he studied in Paris and in 1523 or 24 was awarded the degree of Doctor Regent by the Paris Faculty. After some time spent in the study of surgery he became dean of the faculty and served in that capacity from 1534–37. He died in 1545. As would be expected from his training there is little new in his work as far as advance in practical surgery is concerned. He did, however, adapt what was good in the works of the ancient and medieval surgeons and classify it in a clear and concise manner for the use of those students who understood Latin. He had a great admiration for Guy de Chauliac and his surgery served as the basis for Tagault's work, though many other authors are mentioned. Tagault freely admits this in his preface to the reader in which he states that as Guy de Chauliac borrowed from Hippocrates and Galen so he borrows from Guy, and his endeavor is to clear up the obscure points in Guy's work as it was Guy's to elucidate that of his predecessors.

The work was published in 1543 in Paris by Christian Wechel, a book seller, and consists of the "Five Books of the Institutions of Surgery by Jean Tagault" to which is added a sixth book containing the "Materials of Surgery" written by Jacob Hollerius, a physician of Paris. There is the usual dedicatory epistle, which in this case is written to King Francis I, and this is followed by a Compendium of Surgery which takes up the objects and aims of surgery in the form of short paragraphs some of which are arranged in question and answer form. This occupies twelve pages. The student who read this would have sufficient knowledge of what he was to study to go on to the main work or the five books of surgery. These follow the general divisions of the surgeries of the ancients and are entitled: Book one, tumors contrary to nature, includes the various inflammatory swellings as well as true tumors and also treats of hernia, in which classification varicocele is placed. Book two takes up wounds and their treatment. Book three treats of ulcers and their cure. Book four, the reduction and cure of fractures. Book five, the recognition and replacement of dislocations. The sixth book by Hollerius takes up the various medicaments used in surgery.

Save for three views of the human skeleton the work is without illustrations and one naturally experiences a feeling of pity for the student who had to assimilate the greatly condensed technical detail served up to him without the aid of visual impression. The work represents a distinct advance as a textbook and served in this capacity for many years. Ancient terms are clearly explained and synonyms are always carefully correlated so the student could recognize the terms in all languages. Later authors constantly refer to Tagault and his dicta as authoritative and this work lifted him to the pinnacle of his success. One is amazed at the amount of research that must have been done to produce the work.

[1] Reviewed through the courtesy of the John Crerar Library, Chicago.

IOANNIS TAGAVLTII AMBIANI VIMACI, PARISIENSIS MEDICI, DE CHIRVRGICA Inſtitutione libri quinque.

His acceſſit ſextus liber de materia chirurgica, authore Iacobo Hollerio Stempano, medico Parisienſi.

PARISIIS.
Apud Chriſtianum wechelum, ſub ſcuto Baſilienſi, in vico Iacobæo: & ſub Pegaſo, in vico Bellouacenſi. M. D. XLIII.

Cum Priuilegio.

REVIEWS OF NEW BOOKS IN SURGERY

CERTAIN sections of Carson's *Modern Operative Surgery*[1] seem to us particularly well written and worthy of special mention. Platt's monograph on operations on nerves, Choyce's chapter on operations on the tongue, Handley's discussion of the operative treatment of malignant disease and breast operations, and Walton's chapter on operations on the thyroid are a few of many sections that appeal to the reader as particularly well studied and helpful. Carson's chapters on gastric surgery and excision of the rectum are splendidly illustrated, and written with especial attention to technical details. Turner's discussion of operations on the liver and bile passages is an admirable and comprehensive presentation of the surgical treatment of diseases of the bile tract.

Included in the second volume are sections on the surgery of the ear, the eye, the nose and pharynx, the larynx and trachea, on gynecological operations, and five chapters by Thompson-Walker and Everidge on genito-urinary surgery. The inclusion of these special subjects helps to give a comprehensive and well-rounded view of the field of operative surgery.

A few critical suggestions may be worth recording. In the extensive section devoted to gastro-intestinal surgery no mention is made of duodenal ulcer and its treatment except in connection with acute perforation of peptic ulcers. In the discussion on obstruction of the small intestine the statement is made that "enterostomy, which may be called the last resource in small-intestine obstruction, nearly always ends disastrously." This does not seem in accord with many recorded experiences in which a two-stage operation, i.e., a preliminary enterostomy and secondary operation later, proved the successful solution of a difficult problem. The advisability of primary closure of the abdomen after cholecystectomy is not considered. Purpura hæmorrhagica is omitted as an indication for splenectomy. With reference to the operative removal of pituitary tumors the statement is made that "the operation is associated with such a risk to life and is followed by such doubtful benefit that it is questionable whether any radical operation is justifiable." In the section on the treatment of trigeminal neuralgia considerable space is given to a discussion of alcohol injections, division of the second and third divisions of the nerve with occlusion of their foramina, and removal of the gasserian ganglion, and but two paragraphs to division of the sensory root, a method which has come to be recognized as the one satisfactory form of surgical treatment.

The last four points emphasize what seems to us a real omission—the small number of references to the literature of recent years. One feels that in presenting a new work on surgical treatment the authors should give particular consideration to the advances that have been made in surgical fields since other and similar works have appeared. Of some forty references in the section on gastric surgery, for example, we noted only two to articles that appeared after 1922. On page 570 the statement is made that "the latest results of resection of the stomach from a large clinic are contained in an article by C. H. Mayo, published in August, 1919."

S. L. KOCH.

The excellently prepared compendium on surgical technique by Printy[2] is bound in loose leaf form with the expectation of adding sections as advisable. Up to the present time, the subjects covered are: general operative technique, operations on the intestines, stomach, gall bladder and bile ducts, operations for inguinal and femoral herniæ, operations on the kidney and ureter, the breast, the thyroid gland, and the blood vessels.

The articles are short, concise, but cover the essential points of technique. They are beautifully illustrated and the drawings were made by W. C. Shepard.

IN this mechanical age, when the cystoscope, the microscope, the sphygmomanometer, the fluoroscope, and innumerable other instruments are being relied upon more and more in establishing a diagnosis, *Diagnostik mit freiem Auge*[3] compels especial interest. To be able to make a diagnosis by means of the unaided eye would seem impossible to most of us except in a limited number of cases, such as some conditions of the skin and possibly bowlegs. We are ever in the habit of bemoaning the lost art of careful observation, but it does not occur to us to try to resurrect that art. Weiss has attempted to do this. And in the attempt Weiss has found that careful inspection of the patient will in a large number of cases reveal more than our most elaborate of laboratory instruments. In a very detailed manner, the author describes his method of ectoscopy (careful, scrutinizing observation, as differing from endoscopy which is applied to the inside of the body with the use of instruments or from other methods such as percussion, X-ray examination, etc.) especially in reference to intrathoracic conditions. The results of his studies are extremely interesting, and the scope surprisingly wide.

The chief merit of the book, outside of the use the method may be put to in a certain limited number of cases, lies in the fact that the author emphasizes the importance of careful observation.

RALPH BOERNE BETTMAN.

[1] MODERN OPERATIVE SURGERY. Edited by H. W. Carson, F.R.C.S. (Eng.). Vols. i and ii. New York: William Wood & Company, 1925.

[2] SURGICAL TECHNIQUE. By Emmett A. Printy, M.D. The Laboratory of Surgical Technique of Chicago.

[3] DIAGNOSTIK MIT FREIEM AUGE (EKTOSCOPIE). By Eduard Weiss. Berlin and Vienna: Urban and Schwarzenberg, 1925.

IN the booklet on the surgical treatment of pulmonary tuberculosis, Gravesen,[1] discusses the indications, methods and results of the surgical treatment of tuberculosis of the lungs as used at the Vejlefjord Sanatorium, Denmark.

For many years, Gravesen has been the medical director of this sanatorium. Like his predecessor Christian Saugman, and like several other European authorities on tuberculosis, Gravesen is not only a clinician but a roentgenologist and surgeon as well. Thus in this book we have a résumé of the work done in a large sanatorium, over a long period of years, written by a man whose experience is not along one single line of treatment or one method of examination, but by an author who is equally skilled in diagnosis whether medical or roentgenological, and in treatment whether medical or surgical.

The book describes briefly, concisely, and very clearly the various surgical procedures in the treatment of phthisis. The indications, and contraindications, the steps in technique, and the prognosis are discussed. The text is well illustrated by diagrams, drawings, photographs, and numerous reproductions of X-ray plates.

To the reviewer it seems that the indications for the operations discussed are very sound, that the procedures advocated are very sane.

The book covers the subject of the surgical treatment of pulmonary tuberculosis very thoroughly and concisely, and will prove of great value to any physician treating phthisic patients, or to any surgeon operating for the relief of tuberculosis of the lungs.

RALPH BOERNE BETTMAN.

TWO volumes of the new series of the *Précis de Technique opératoire*,[2] on minor and emergency surgery, and surgery of the urinary system and male genital system, have been received. As in the past these two volumes excellently fulfill their intended mission. In short and concise form the technique of the various operations as practiced by the authors is described. In the volume on urgent surgery the chief indications are mentioned; in all other volumes only the operative technique is discussed. The series is published for students and for general practitioners whose wide sphere of activity requires a short treatment of a subject.

The reviewer has been extremely interested in reading these two little books not only because of the many excellent technical procedures found but especially because much of the French surgical thought and attitude is reflected from their pages.

RALPH BOERNE BETTMAN.

[1] SURGICAL TREATMENT OF PULMONARY TUBERCULOSIS AND PLEURAL TUBERCULOSIS. By J. Gravesen, M.D. New York: William Wood & Company, 1925.

[2] PRÉCIS DE TECHNIQUE OPÉRATOIRE. PRATIQUE COURANT ET CHIRURGIE D'URGENCE. APPAREIL URINAIRE ET APPAREIL GÉNITAL DE L'HOMME. By V. Veau and F. D'Allaines. 7th ed. Paris: Masson et Cie, 1924.

SURGERY, GYNECOLOGY AND OBSTETRICS

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INAUGURAL ADDRESS WITH REMARKS ON ENDO-ANEURISMORAPHY[1]

BY RUDOLPH MATAS, M.D., F.A.C.S., NEW ORLEANS, LOUISIANA

DURING the first 7 years of the existence of the American College of Surgeons, it was my good fortune to have been associated with its directorate as one of its vice presidents. Thanks to the robust health of our presidents and to the smooth running of the administrative machinery, my duties were largely, if not entirely, nominal; but they gave me an opportunity to acquaint myself with the magnitude of the enterprise in which the College had embarked and the complexity of the problems that it had to solve. It also gave me an opportunity to admire the knowledge and skill of the captains who guided its destinies.

And, now, that, through your grace, I am here, I realize more than ever that what little I may have done to live up to the ideals of the organization and to serve its interests, may it be said, with a whole hearted devotion to its purpose, has been crowned with a reward out of all proportion to any personal merit that I may possess or that may be attributed to me. I therefore interpret your action as a gracious compliment to the surgeons and surgical institutions of the South, to which I belong, who form so large a part of the constituency of the College and whose loyalty, unfailing support and championship of the principles of this College since its foundation, you deemed worthy of recognition.

If I am right in this interpretation, I feel doubly honored, as there is nothing I hold dearer, no distinction that I prize more highly, than to be honorably identified with the people, the profession, and the institutions of that section of our Southern country which gave me birth and with which I am inseparably united by ties of affection and devotion that are as precious and enduring as life itself.

A thought that is well calculated to moderate any sense of exaltation that might spring from the new dignity which you have conferred upon me is that of the obligations that attach to it. Not the least of these is to maintain the high standard set by my illustrious predecessors in office. When I think of the great leaders who have adorned the presidential chair during the thirteen youthful but momentous years that this College has been in existence, when I recall the names of John M. T. Finney, George W. Crile, William J. Mayo, George E. Armstrong, John B. Deaver, Harvey Cushing, the late Albert J. Ochsner, and Charles H. Mayo, when I think of these, I see before me a group of stalwart giants towering above the multitude, whose surpassing vision I would envy were it not for the comfort that I find in the fabled legend of the dwarf and the giants, told by our ancient Master, Guy de Chauliac, to encourage his ambitious students. The dwarf eager to see, but denied by his stature, was rewarded by a splendid view of treasures of marvelous wealth by climbing and standing on the shoulders of giants. Likewise, by standing on the

[1] Read before the Clinical Congress of the American College of Surgeons, Philadelphia, October 28, 1925. A motion picture was used as a basis for the technical part of this address.

shoulders of my predecessors, what a privilege this is that I should be vouchsafed the opportunity of gazing upon the inspiring and magnificent panorama offered by the ever expanding conquests of American surgery.

As I survey this brilliant assembly of the most representative surgeons in America, gathered before me, and read the past, the present, and the future in the earnest faces of the men and women who represent the diverse generations of productive workers in our special domain—including those who have accomplished, those now accomplishing, and those who are still to accomplish, the great deeds that are to exalt and perpetuate our traditions—I feel more than ever thankful for the privilege of viewing so glorious a prospect from this commanding height.

But, while I have reason to approach my duties with some doubt and trepidation, I am confronted and reassured by the fact that I am here solely to execute your good will, to carry out your mandates, and to strive for the attainment of the high purposes and ideals which each and every one of you, my dear Fellows, has pledged himself to hold, to defend, and to enforce, if need be. With your support and under the direction of the splendid men whom you have chosen for your directorate, the Board of Regents, and aided by the generalship and vision of that watchful and tireless guardian of the machinery of our organization, our Director General, he, whose counsel, as originator and founder of the College, always commands our confidence and highest respect, Dr. Franklin H. Martin, I have every reason to believe that, at the end of my encumbency, another year of progress will have been added to the unexampled and phenomenal record of achievement of this wonderful institution, an institution which, in its national and international breadth and scope, in its origin and altruistic purpose, has no parallel in the world's history, an institution which we can claim without vainglory as one of the most beneficent contributions that the twentieth century has given to American surgery and, through surgery, to the American people—The American College of Surgeons.

And now, as I see the sands in the hourglass flowing fast, I am reminded that I must not loiter, since, as incoming president, I am expected to deliver an inaugural address.

This function, as I view it, offers a legitimate opportunity for indulging in the amenities and sentimentalities that spring from the emotions of an occasion of this character. In this, I fear I have already trespassed beyond my privileges. It is also customary in an inaugural address to refer to, if not review, the past of the organization and to forecast its future; but I have been relieved, in a large measure, of this phase of my function, by our Director General, Dr. Martin, in an admirable report of the activities of the College, embracing its history from its origin to the date of our last convocation in New York—which is so luminous an account of our purposes, policies, and accomplishments that it would be mere presumption to do more than refer to it as an evidence of his statesmanship, perspicacity, and acknowledged genius for the direction and management of public affairs.

Whatever would be left to do in the way of discussing debatable points, constructive criticism, and commentary, or counsel, for our guidance in the future, was also accomplished in a masterly and scholarly fashion in his Fellowship address, delivered on the same occasion, by our brilliant and devoted Canadian Regent and former vice president, Dr. Chipman of Montreal.

In analyzing our College government, he finds it not only representative and democratic but simple and effective, and, in this view, no one who has lived under our constitution and by-laws can scarcely disagree with him. Here, the voters, numbering nearly 7,000 active Fellows, are represented by the 150 governors whom they elect for a term of three years, and of whom 50 are chosen annually by the Fellows. This, then, is our House of Representatives. The governors in turn elect 16 Fellows who, including the president, the vice president, the director general, and the treasurer, ex officio, constitute the Board of Regents. They act virtually as the senate of the College. The electoral power, therefore, resides in the Fellows, and it is the Fellows who own the College, and its destinies lie in their hands. In this way, the College is as far removed from class domination as it is pos-

sible for our constitution and by-laws to make it. Furthermore, ours is a democracy which is not disturbed by the clashing of party lines. It is held together by a unity of purpose which allows of no division. In this, your president is again fortunate. Viewed in the light of established precedent and the immense significance that is attached to an inaugural address when the orator is the spokesman of a political party, dominant in the affairs of government, an inaugural address is one to whose message the modern world harkens with ears bent to the ground, or rather, in a more modern way, to the 'phone, to the radio, or reads the news with eyes fixed on the glaring bulletin in the street, with anxious expectancy. In party politics, an inaugural address is the voice that confirms the pledges and policies of the platform of the new administration. How happy is your president that he has no party policies to announce, no party interests to promote or protect, no pledges to redeem, no anticipated favors to bestow. No, nothing but to stand firmly on a platform built upon a solid rock and immutable as the ages, therefrom to proclaim his allegiance and fealty to the will of his constituents, they, who have, all and singly, pledged themselves to support, maintain, and defend a constitution which is based upon the principles of right conduct in the exercise of their professional mission; principles which are to remain inviolate and imperishable as long as the heart of humanity is true to itself.

ENDOANEURISMORAPHY[1]

Having been relieved in this comforting way of what I interpret as the official phase of an inaugural address, I will avail myself of the remaining time allowed for this function to indulge my personal inclinations in a more familiar domain. Profiting by this license, I will invite you to my workshop in New Orleans, where you may witness the performance of an operation which I trust you will find sufficiently interesting to justify its presentation on this occasion. I will relieve you of the tedium and inconvenience of a long trip to New Orleans by transferring my surgical clinic to Philadelphia, where you will see an operation for the radical cure of aneurism by the method of intrasaccular suture, or endoaneurismoraphy—with which you are all, no doubt, familiar through the textbooks, but not in the personal way that you will see it today.

In selecting this motion picture as the basis of my technical address, I have been prompted by several considerations, not the least of which is the desire that the official duties which devolve upon me as your incoming president shall not fall too heavily upon you at the very start of your arduous labors.

As a preliminary to the exhibit, I must beg your indulgence for a few moments longer for an explanation of the operations that are to be projected upon the screen. The picture tells the story of four patients operated upon for unusual types of ruptured post-tibial and femoropopliteal aneurisms. They were the first of a group of five patients operated upon last summer in my clinic at the Charity Hospital, all operations involving the arteries of the lower extremity. They were selected not only because they were the first available for the present purpose, but because they illustrate the obliterative intrasaccular method of suture, which is the simplest and most frequently applicable of the three conservative procedures which I first performed in March, 1888 (37 years ago), but which I did not systematically describe until 1903 (14 years later), 23 years ago. I need not detain you with a description of these three procedures, since they have been so frequently described in the many articles that I have contributed to the subject, and since the operation has been so often performed and made familiar by my colleagues in America and in foreign countries, and not the least in frequency and success by a number of my distinguished friends and colleagues in Philadelphia.

Suffice it to say that, in the collected statistics which I have been able to gather from my own practice, amounting to over 69 operations, and those of other surgeons at home and abroad, fully 80 per cent of 478 recorded op-

[1] The spelling of the word "endoaneurismorrhaphy" is in accordance with the classical orthography of the dictionaries. In revising the proof, Dr. Matas writes that he regards this spelling of the word as archaic and has personally abandoned it in favor of the contracted word "endoaneurismoraphy" as given in this article. This is equally descriptive and faithful to its Greek origin, but much simplified by the elimination of unnecessary consonants in accordance with the rules of the Carnegie Spelling Board.—EDITOR.

erations have been of the obliterative type. In 20 per cent the conditions favorable for a reparative, restorative, or reconstructive operation have been found and utilized for these essentially conservative procedures.

I have not included in my list of 478 cases a considerable number of operations performed by European, especially German military surgeons during the World War, in which the principles of my restorative endoaneurismoraphy have been successfully applied to traumatic aneurisms, but without any recognition or acknowledgment of the source from which they were derived. The results obtained by these operations continue to be even more gratifying than when I first submitted a report of the first 225 to the International Congress in London, in 1913, and vary little from the report of 350 operations which I later submitted to the French Surgical Congress in 1922. The deaths that can be directly attributed to the operation (apart from the aortic) do not exceed 4.5 per cent; the gangrenes, 3.5 per cent; secondary hæmorrhage, 1.6 per cent, and the relapses in less than 1 per cent. These operations include all the surgical arteries of the extremities, from the iliacs to the foot, from the subclavian to the hand. I treat the aneurisms of the neck, subclavian and innominate tracts primarily by the simple occlusion of these great vessels with pliable aluminum bands or tape ligatures, applied as closely to the cardiac pole of the aneurism as is possible. The results obtained by this method—which will be made the subject of a separate publication—have been so satisfactory and curative that, with the sole exception of the arteriovenous aneurisms of these vessels, I have not had to resort to more radical procedures.

The obliterative operation, which consists essentially in a direct incision into the sac without dissecting it from its surroundings, the evacuation of its contents, and suture of every visible orifice within the sac, that might bleed, followed by the obliteration of the sac cavity, by infolding or plicating its walls, or filling it by inverting and approximating its muscular walls, is by far the most conservative, simplest, and safest of the radical operations for the cure of aneurisms of the extremities. Since I have learned with increasing experience how to determine the efficiency or inefficiency of the collaterals, by the four tests that I have found most practical and dependable, namely: (1) the hyperæmia reaction or modified Moszkowicz color test; (2) the preliminary occlusion of the main artery close to the proximal pole of the sac, with pliable and removable bands; (3) oscillometric manometry, to determine the peripheral blood pressure after the temporary occlusion of the main artery; and, lastly (4) the clinical evidence of a persistent circulation and nutrition of the peripheral parts, in spite of the permanent absence of the peripheral pulses (the Delbet test); since I have also learned that, by systematic compression of the main artery at its entrance into the sac, a deficient collateral circulation can be greatly improved in the large majority of cases with the help of other physiotherapic measures which tend to stimulate the capillary circulation, I have found the indications for the reconstructive operation less frequent.

As it is impossible to determine before opening the sac and examining its interior whether an obliterative or restorative procedure is applicable, the surgeon should always proceed with the possibility and, in fact, probability, in mind, that an obliterative operation will become necessary. Hence, the capital importance of the study of the collateral circulation in every case in which it is at all possible to observe the behavior of the distal parts, upon occlusion of the main artery at the cardiac pole of the aneurism. This preliminary study of the collateral circulation is one of the most important advances in the surgical treatment of aneurism and should be regarded as an obligate duty before any direct action upon the aneurism is undertaken.

CONCLUSIONS

I regard it as a fundamental principle that the surgeon should undertake all operations for aneurism with a conservative spirit. He should aim at the physiological restitution and reintegration of the aneurismal artery, as his ideal; he should not exceed, in his demands, the local reparative resources of the tissues or of the organism.

When operating, the surgeon should not obstinately insist upon re-establishing the continuity of the damaged artery by juggling with complicated, hazardous, uncertain, and adventurous methods. It is for this reason that the operation designated, "ideal" and which consists in excising or resecting the sac and then suturing the stumps of the divided vessel by end-to-end arteriorrhaphy, with or without the interposition of venous grafts, does not figure in my statistics. This will do only for recent pulsating hæmatomata. The ideal operation is that, in reality, which saves the patient and his limb, while ridding him of his aneurism. In the presence of an aneurism, developed in one of the great arteries near the heart, we must reflect a long time before deciding to act. It is then that we should be *eclectic*, selecting that procedure which is most clearly indicated by the condition of the patient and of the limb.

It is not because statistics seem to show that the methods of extirpation or of endoaneurismorrhaphy, or others, yield the greatest number, the most complete, and the most radical cures, that we should decide to attack the central or truncular aneurisms by direct intervention on the sac. In every case, the patient, who is very often a syphilitic subject, with other complicating cardiovascular lesions, should be minutely examined, so that a general inventory of his pathology and an appraisement of his defensive resources may be obtained. In the young, otherwise healthy subjects, suffering from purely traumatic aneurisms, the operator may go very much further in the pursuit of the ideal. But, in the aged and in those vitiated by diseases, whose aneurisms are only a proof of their general arterial degeneration, one must be practical, and the theoretical, technical, and physiological ideal must be subordinated to the primordial consideration of the saving of life.

I reassert: The surgeon should be *eclectic* in his attitude. He should choose the simplest means by which he may suppress the disease. It is in adopting this principle that I always begin an attack on the innominate, the subclavian, the carotid, the iliac, and the ilio-femoral aneurisms, by first occluding the main artery with an aluminum band or, preferably in innominate and left subclavian aneurisms of the first or intrathoracic portion, by tape ligature, without interfering directly with the sac.

It is admittedly a serious enough matter to apply a ligature upon the innominate, or a subclavian, especially at the origin of these vessels, but the procedure, difficult as it is, is far less dangerous or risky an undertaking than to attempt to obliterate or extirpate the aneurismal sac at the same sitting.

We should bear in mind that, in probably 80 to 85 per cent of these cases, the simple occlusion of the main artery is sufficient to obtain a cure of the aneurism. If a relapse follows, it is then time enough to obliterate or extirpate the sac.

In the young, with aneurisms of direct traumatic origin, who are free from syphilis or other constitutional taint, and especially in dealing with arteriovenous aneurisms, I do not hesitate, in a general way, to attack the aneurism by a direct free incision into the sac, followed by the suture of all the communicating openings within the sac. But, even then, I never attempt such a procedure without the most thorough control of the main or injured artery, above and below the sac, by preliminary provisional hæmostasis, with clamps, bands, or temporary elastic ligatures.

Finally, after security or safety, it is the simplicity of any procedure which must appeal to us in deciding our choice of methods. It is by reason of its simplicity in dealing with the accessible and controllable aneurisms, particularly those of the extremities, that I believe that I am serving the best interests of my patients by giving them the benefit of the operation which experience has taught me is the simplest, safest, and surest—endoaneurismoraphy.

NOTE.—In the moving picture that followed this introduction, the patients were exhibited before the operation and after their complete recovery. The details of the technique were shown as the operation progressed from the beginning to the end of the operation including the author's special protective mattress-pad dressings. The more minute details of the procedure which escaped the eye of the camera were made clear by the interposing of a number of semidiagrammatic drawings which were continuous with the moving film.

OVARIAN GRAFTING[1]

By W. BLAIR BELL, B.S., M.D. (Lond.), F.A.C.S. (Hon.), Liverpool, England
Professor of Obstetrics and Gynæcology, The University; Obstetrical and Gynæcological Surgeon, The Royal Infirmary; and Surgeon to the Maternity Hospital, Liverpool. Hon. Fellow American Gynæcological Society, etc.

THE elevation of surgery from mere tissue-carpentry to the more exalted position of a highly scientific recreative art has been due to the general appreciation of the facts that every structure in the body subserves some special function, and, moreover, that although nature has endowed tissues with wonderful powers of recovery and regeneration, and although she may duplicate, she does not issue "spare parts."

So, it has come about that the scientific surgeon of today is a physiologist rather than an anatomist, as obtained in the past; and it has become the essential principle of modern surgery that only those structures shall be removed which are too much damaged by disease to recover, or which are sources of danger or of serious disturbance to the patient. The excision of tissue, therefore, and with it the removal of function is now regarded as a last resort: the surgeon bends his creative powers towards the prevention of loss of function, and this is especially necessary when that function is of general rather than local utility only. Ignorance as to the nature of any particular function, and poor results from imperfect technique may be explanations of preference for eradicative surgery, but they are not excuses.

The grafting of tissues which the operator may be compelled, for one reason or another, to remove from their normal position and connections is undoubtedly one of the most important advances of surgery towards the ideal I have expressed. There is, indeed, no branch of surgical practice that is not feeling its way in this direction, following the lead given by nature in the natural history of animals and plants.

Being myself specially interested in the question of the ovarian function, which I believe to be of paramount importance to the feminine female, I shall illustrate the general thesis set forth by reference to the subject of ovarian grafting.

This procedure has created great interest in America where gynæcological surgeons have, I believe, more respect for the valuable functions of the ovary than obtains in certain parts of this country, where the belief is held that the ovary is an overrated organ.

As I have said, I myself hold the view that the ovaries are of value to feminine women by reason of their internal secretion, quite apart from the excretion of ova; and I believe that nearly all failures to secure satisfactory results from ovarian grafting have been due to faulty technique, and not to the fact that nature gave women ovaries only for the purpose of producing ova.

Before discussing the technique of ovarian grafting, I should like, if I may, to repeat a statement made some years ago (2): "I wish to insist that this procedure be looked upon as a measure of necessity which can never be weighed in the balance against the preservation of the natural connections of the normal ovary."

Acting on this principle I have had what may be regarded as but a limited experience with ovarian grafting—about 200 operations in 10 years. Previously to the year 1916 I had only occasionally performed this operation.

Other surgeons like Tuffier (6) have published rather larger series, but with them the indications for ovarian grafting appear to have been less restricted, and to have been extended to include uncomplicated cases of fibromyoma uteri and other conditions, in the treatment of which this procedure is rarely necessary, unless they are associated with tubal infection.

INDICATIONS FOR OVARIAN GRAFTING

In view of what I have just said, the indications for ovarian grafting resolve themselves, then, into the consideration of the maintenance of the ovarian function, only when it is impossible to leave an ovary, or part of an ovary, in the normal site during the reproduc-

[1] From the Department of Obstetrics and Gynæcology, The University, Liverpool. A short lecture delivered to the American Interstate Postgraduate Assembly at a meeting held in Liverpool, June 8, 1925.

tive period—that is, in patients before the age of 45 years or thereabouts. Such an eventuality is usually produced by genital infections of an ascending type, principally gonorrhœal. It will be seen from the table that salpingo-oophoritis was the primary lesion necessitating ovarian transplantation in 96 per cent of my cases, and that excluding puerperal salpingo-oophoritis and infections associated with other lesions, ascending infections of gonorrhœal origin produced the primary lesion in approximately 82 per cent of all my cases. In Tuffier's series of 230 operations the primary lesion was unqualified salpingitis in only 61 per cent.

The literature has, however, been so admirably analysed up to the end of 1921 by Franklin Martin (4) that those interested in a general survey I would refer to his paper. Here I am concerned in giving an outline of my own practice.

To resume, it should not for a moment be imagined that because the case is one of salpingitis the ovaries must be transplanted; this is far from being the case. Often it is possible for the surgeon to cut through the mesosalpinx and to remove a diseased tube without injuring the ovarian blood-supply (Fig. 1. B). When, however, there is a large pyosalpinx the two layers of the mesosalpinx may be widely separated, and any attempt to excise the tube alone leads to interference with the ovarian vessels (Fig. 1, C). It is this that causes the ovary, if it be retained in the pelvis, to undergo "cystic degeneration"; that is to say, dehiscence of ripe follicles does not occur.

In fibromyomatous disease of the uterus, when there is no associated salpingitis, it is almost always possible to conserve one if not both ovaries; and I disagree entirely with those who assert that the ovary is a useless appendage in the absence of the uterus. Nevertheless, if the uterus or a portion of it can be preserved, this should always be done in the surgical treatment of fibromyomata uteri and pelvic infections. It was to meet this requirement that I devised what is now generally known as the Bell-Beuttner operation for lesions produced by ascending infections, whereby a transverse wedge-shaped portion of the infected fundus uteri is removed along with the tubes (1).

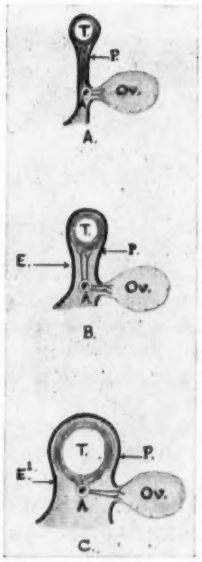

Fig. 1. Diagram showing the danger to the ovarian blood supply upon removal of the fallopian tubes for salpingitis. *ov.*, Ovary; *t.*, tube; *p.*, peritoneum; *a.*, ovarian artery.

A. Relation of the normal tube and ovary. The mesosalpinx is long, and in it run the tubal branches of the ovarian artery.

B. Salpingitis has produced moderate enlargement of the tube. In such a case, salpingectomy through the mesosalpinx at the point *E* would necessitate division of the tubal branches of the artery, but would leave unaffected the ovarian artery itself.

C. Salpingitis has produced a pyosalpinx with considerable enlargement of the tube and consequent obliteration of the mesosalpinx. Salpingectomy at the point *E'* would inevitably lead to interference with the ovarian blood supply.

Bilateral innocent cystic neoplasms are comparatively rare, although it is a very common occurrence for the gynæcologist to see several retention follicular cysts of the same size as that of a plum in both ovaries, but these can almost always be excised without the necessity of removal of the ovaries.

TECHNIQUE OF OVARIAN GRAFTING

When the surgeon has decided that it is impossible safely to conserve any ovarian tissue in the normal position, the next consideration arises in regard to the best method of implantation. Here let me say that it is generally

Fig. 2. Having been cut up in crisscross fashion with a sharp knife on a rubber pad, the ovarian tissue is ready for grafting.

conceded that to secure a functional result the procedure should always be autoplastic; that is to say, ovarian tissue from the patient herself must be transplanted. Homoplastic grafting with ovarian tissue from another woman is very rarely effectual; and heteroplastic ovarian implantation with tissue from another animal is useless.

The ovarian tissue removed is separated from other structures, such as the tube, and a long silk thread on a sharp needle is passed through it. The two ends of the thread are knotted together, and the ovary so tethered is placed in the pouch of Douglas, or elsewhere in the peritoneal cavity, the ends of the thread being brought through the laparotomy opening and held in a pair of forceps. In this way the ovarian tissue is kept moist and warm in natural surroundings until required for grafting.

When the operation for the primary lesion has been completed, but before the laparotomy wound is closed, the ovary is recovered by withdrawing the thread attached to it, and is placed on a small square of rubber 6 inches in diameter, and about ¼ inch in thickness, which has been sterilized in readiness. A very sharp grafting knife is taken, and the hard cortex is shaved off the ovary or pieces of ovary, as the case may be. Then, by a series of crisscross incisions, the whole piece of ovary is divided into small parts which are still held together by the underlying layer of tissue (Fig. 2). It is merely for convenience in handling that the ovary is not cut into separate fragments. The exposure of such a large area of surface and the limited size of the fragments tend to ensure rapid vascularization of the implanted tissue. There is also less chance of follicular cyst formation.

Next, the aponeurosis covering the rectus on one side of the laparotomy incision is seized with a pair of compression forceps and drawn towards the operator, who with a knife carefully makes a small incision through the upper surface, avoiding all vessels. The blunt point made by the closed blades of a long angular compression forceps is passed through the opening in the rectus sheath and gently forced into the body of the rectus muscle *parallel to the surface*. The blades are then slowly separated (Fig. 3). It is most important that there be no bleeding, for, although grafts must be implanted in vascular areas, if the grafted tissue is bathed in blood it cannot become attached to the surrounding structures from which nutriment is to be drawn. The ovarian graft is now passed into the middle of the muscle and laid flat among the fibers. The edges of the opening in the rectus sheath are brought together with a couple of sutures, and the laparotomy wound is closed.

If the infection in the pelvis be recent and drainage is considered advisable a tube is passed through a stab-wound outside the rectus muscle to the bottom of the pouch of Douglas; and in these circumstances the ovarian implantation is made in the external oblique muscle close to the drainage tube.

I have also grafted the ovarian tissue into the uterus, or into what was left of the organ; and I have wrapped it in the free border of the omentum. But considering the ease with which the whole procedure just described is performed, and the advantage of the site for subsequent observation, implantation in the rectus muscle, which satisfies the requirement of vascularity, is preferable to grafting elsewhere.

AFTER-HISTORIES AND RESULTS

In spite of the fact that the greatest care has always been taken to secure adequate information concerning the after-histories of patients subjected to operation in my department, and in spite of the additional interest

taken in securing the attendance of, or replies from, those on whom new procedures have been practised, it appears to become increasingly difficult to secure co-operation on the part of hospital patients, who are a shifting population. In a previous enquiry (2) it was found impossible in 20 per cent of all cases to secure after-histories. In the table given here, which includes the cases previously reported, it will be observed that after-histories have not been obtainable in 30 per cent of all cases subjected to ovarian grafting.

After the ovaries have been completely removed from the normal position, and even though ovarian tissue has been transplanted, there is a period between the operation and the time when the graft has become completely vascularized and is supplying internal secretion to the host during which the patient may suffer with all the physical and psychical disturbances of the menopause. The duration varies from 1 to 8 months after operation. The average time is about 4 months; and as soon as the transplanted tissue becomes fully functional these disturbing symptoms disappear, often coincidentally with the reappearance of menstruation, if that be possible.

I have sometimes prescribed ovarian and thyroid substances when this temporary menopause has given rise to severe manifestations; but this is rare.

In the table it is shown that in the whole series analysed functional results were obtained in 83 per cent of the cases. In figures of about half of the whole number published in 1920 (2) the functional results recorded reached 80 per cent. It appears, therefore, that by the method practised functional results may be expected in a little over 80 per cent of all cases.

TOTAL NUMBER OF CASES RECORDED, 187

Indication for graft:

A.	Salpingo-oophoritis—173	
	Primary lesion (including 4 cases of puerperal infection)	157
	Associated appendicitis	4
	With fibromyomata	11
	With tubal gestation	1
B.	Innocent neoplasms of ovaries—13	
	Endometrioma	4
	Other neoplasms of both ovaries, or of remaining ovary	9
C.	Ovarian pain with functionless uterus	1

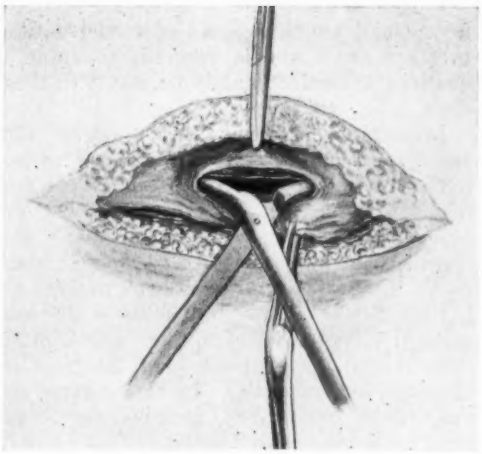

Fig. 3. Method of preparing a bed in the rectus muscle for the ovarian graft.

TOTAL NUMBER OF CASES EXCLUDED, 69

A.	Operation within 6 months	9
B.	(1) Died after operation (Mortality rate 1.07 per cent)	2
	(2) Have died since from other causes	2
C.	Failure to obtain complete after-histories	56

TOTAL NUMBER OF CASES ANALYSED, 118

A.	Total cases in which menstruation was possible	107	
	Menstruation occurred in	71	(66.3%)
	No menstruation and no menopausal symptoms	21	(20.0%)
	No menstruation and menopausal symptoms	15	(14.0%)
B.	Menstruation impossible owing to supravaginal or complete hysterectomy	11	
	No menopausal symptoms	6	(54.5%)
	Menopausal symptoms	5	(45.5%)
C.	Functional results in	98	(83.0%)
	Failure to obtain functional results in	20	(17.0%)

By "functional results" we mean that the symptoms of the menopause are abolished, at any rate after the first few months following operation, and do not reappear for some years.

It will be noted also that in those patients in whom a portion at least of the uterus was conserved—usually by the Bell-Beuttner procedure—menstruation reappeared in no less than 66 per cent. This is the same percentage for the whole as obtained in the first half of my cases; consequently, it may be confidently anticipated that menstruation can be conserved in this large number of all cases.

I need not urge the importance—physiological and psychological—of menstruation, to the woman who is normally feminine, a qualification unfortunately necessary in these days.

Menstruation when it appears may be quite regular for many years. A number of my patients are still menstruating normally and regularly 7 years after operation. On the other hand, some menstruate irregularly and scantily, and may cease to have their catamenia after a few months or after menstruating for a year or two, but in these the subsequent menopausal symptoms are slight if present at all. Such results may, therefore, be classified as functional. In this matter age may be of importance, because we cannot expect the ovaries in a woman of 40 years of age to function so well as those of younger women, yet I notice among my cases one woman of 40 years of age who "menstruated more or less regularly for 3 years."

With regard to the graft itself, it is frequently recorded in my series that periodical swelling with pain and tenderness occurs. If, however, the cause of this be explained to the patient, she always prefers to suffer this slight inconvenience rather than have the graft removed. One woman explained her anxiety to continue menstruating on the ground that she wished to marry. She, as indeed are many women, was under the impression that a woman should not marry unless she is able to menstruate. This experience alone would have been an incentive to me, if I had had no other, to endeavour to perfect the technique of ovarian grafting.

Sometimes—it has happened twice in my series—a small follicular cyst forms in the graft and causes, as it may do when the ovary is normally situated, menorrhagia or epimenorrhagia. It is a simple matter when the tissue is grafted in the rectus to cut down under local anæsthesia and remove the cyst. Similar experiences have been recorded by Miller (5), Lack (3), and others.

My conclusions regarding ovarian grafting have been given on previous occasions, and have been set forth by Franklin Martin in the paper to which I have referred. I shall, therefore, content myself by repeating that in my opinion the question of the employment of ovarian grafting in preference to the so-called "clean sweep" is no longer open to discussion: ovarian transplantation is a procedure no scientific gynæcological surgeon can afford to neglect. It only remains for us to select the proper cases, and endeavour so to perfect the technique that in the future we may prophesy, even more definitely than we can today, a successful result. In spite of the fact that there are those who are bold enough to say that they "have never seen any bad menopausal symptom follow complete removal of both ovaries in young women," we must pursue surgical ideals, which we ourselves may never reach, in order that those who follow after may convert them into realities.

I am indebted to Dr. S. B. Herd, gynæcological registrar at The Royal Infirmary, for collecting and analysing the after-histories of the patients.

REFERENCES

1. Bell, W. Blair. Surg., Gynec. & Obst., 1914, xvi, 634.
2. Idem. Lancet, 1920, ii, 879.
3. Lack, V. G. Proc. Roy. Soc. Med. (Sect. Obst. & Gynæc.) 1924, xvii, 33.
4. Martin, Franklin H. Tr. Am. Gynec. Soc., 1922, xlvii, 11.
5. Miller, C. J. New Orleans M. & S. J., 1924, lxxvi, 547.
6. Tuffier, T. Bull. Acad. de méd., Par., 1921, lxxxvi, 99.

ONE THOUSAND OPERATIONS FOR GASTRIC, DUODENAL, AND JEJUNAL ULCERS[1]

By DR. VICTOR PAUCHET, Paris, France
Surgeon to St. Michael's Hospital

DURING the past 25 years, I have performed one thousand operations for gastric, duodenal, and jejunal ulcers, divided as follows: 367 for gastric ulcer, 536 for duodenal ulcer, 58 for gastric and duodenal ulcer combined, 39 for postoperative jejunal ulcer.

Operations for hour-glass stomach are included in the above, but I have omitted 33 operations for acute perforation of gastric and duodenal ulcers.

GASTRIC ULCER

The immediate mortality was as follows: gastro-enterostomy alone for duodenal ulcer, 1 case, 2 per cent; gastrectomy for duodenal ulcer, 2 cases, 5 per cent; resection for gastric ulcer in proximal third of lesser curvature, 9 per cent; resection for ulcer in the prepyloric portion or in the middle third of the lesser curvature, 1 case, 4 per cent.

Prior to 1905, I limited my intervention to gastro-enterostomy with a mortality of 8 per cent. From 1905 to 1910, a wedge-shaped excision of the ulcer-bearing area alone was done with a mortality of 20 per cent. Since 1910, i.e., for the past 15 years I have performed 367 operations for gastric ulcers. Of these there were 20 Balfour operations, 4 gastro-enterostomies, 18 annular (sleeve) resections and 327 gastrectomies (gastropylorectomies) after primary division of the duodenum. When speaking of gastric ulcers, reference is always to those of the lesser curvature because I have never observed one at any other portion of the stomach.

The term pyloric ulcer is a misnomer because in reality they are either duodenal or gastric (when the latter, they are near the pylorus).

The end-results of gastric ulcer operations are better when one removes a large portion of the stomach. The more one resects, the greater the percentage of cures.

In 18 sleeve or annular gastric resections, a cure was obtained in only 3 cases after an extensive gastrectomy.

The Billroth I method is my first choice but whenever this cannot be performed, I resort to the Pólya method. The Billroth II has never been employed. In 4 cases, a secondary operation was necessary after the Billroth I, because the duodenum was stenosed. I limit the Billroth I to cases in which the duodenum is relatively large. When this is not the case, I always employ the Pólya method.

In very high lying ulcers a total gastrectomy was performed in 5 cases while in 21 cases I resected the lesser and three-fourths of the greater curvatures, a method to which we apply the term resection *en gouttière*. This method is followed by the most satisfactory end-results.

In 2 cases there was a recurrence after the Balfour method and we were obliged to do a secondary subtotal resection which was followed by complete relief of symptoms. Microscopic examination of the specimens in these 2 cases revealed evidences of malignancy. It may be of interest to add that we have found typical carcinomatous changes in 15 per cent of 200 consecutive gastrectomies for ulcer which were subjected to microscopic examination.

Gastropylorectomy (practically a subtotal resection) is the operation of election in gastric ulcer for the following reasons:

1. Because it eliminates bleeding, pain, gastric symptoms, and the chances of malignant degeneration.

2. Local resections like those of Balfour or gastro-enterostomy alone do not prevent a recurrence. We have never observed such an end-result after gastropylorectomy.

DUODENAL ULCER

In a total of 536 operations, gastro-enterostomy alone was performed in 213 cases. During

[1]Prepared for presentation before Clinical Congress of American College of Surgeons, October 26 to 30, 1925. Not read because of illness.

recent years, I have either added cautery puncture and subsequent infolding of the ulcer-bearing area to the gastro-enterostomy or I have employed the Finney operation. For the latter considerable mobility of the stomach is necessary, otherwise the method may be fraught with danger.

In 130 cases of duodenal ulcer, gastrectomy with resection of both the duodenum and stomach has been done. This has also been our practice in cases of combined gastric and duodenal ulcers.

Gastro-enterostomy alone is ideal in cases of fibrous duodenal stenosis when there is no hyperchlorhydria and the ulcer is latent.

In cases of duodenal ulcer associated with gastroptosis, the Finney method gives the most satisfactory end-results.

When the duodenal ulcer is in an active stage and the acidity normal, we prefer cauterization followed by infolding of the ulcer-bearing area and a gastro-enterostomy. If, however, there is marked hyperacidity, we believe that only an extensive resection of the stomach and involved portion of the duodenum should be done.

Gastropylorectomy for duodenal ulcer is more difficult technically than for gastric ulcer. This is especially true when the duodenal stump is adherent to the pancreas.

We have never found microscopic evidence of malignant changes in duodenal ulcers.

One should never fail to examine the biliary tract in operation for gastric or duodenal ulcer. Cholecystectomy or drainage as the case requires can be done at the same sitting as the other operations.

An appendicectomy is done as a routine measure.

It is very important to give the patient a proper diet and to follow the case for a year at least. Care of the mouth, teeth, tonsils, nose, and of constipation is not to be overlooked. Tobacco is to be avoided and the following articles of food reduced to a minimum: meats, fish, eggs, and milk.

JEJUNAL ULCER

When we performed gastro-enterostomy alone for duodenal ulcer, a jejunal ulcer was observed at the stoma in 5 per cent of the cases. Since we have changed our type of operation for duodenal ulcer, as described in the preceding portion of this paper, we have not seen a single jejunal ulcer in our cases. The only jejunal ulcers found by us at operation in recent years were in patients operated upon by other surgeons.

In none of these had a radical gastric resection been performed.

A gastropylorectomy was the method of treatment in 39 jejunal ulcers with 4 deaths. We have resected the major portion of the stomach, including the gastrojejunal stoma. Such a subtotal gastrectomy is the method of choice to prevent recurrence. In 35 of 38 cases, the patient was cured.

The most serious complication of a jejunal ulcer is a gastrojejunocolic fistula. In order to save the patient's life, an operation should be done as soon as the condition is even suspected. The mortality of a separation of the viscera and closure of the openings, is still very high. We have been most successful with the following procedure: resection *en bloc* of the stomach and colon segments of the fistula, if possible without opening the lumen of both viscera. In our hands the mortality of operations for such fistulæ has been very high, namely, 30 per cent.

CONGENITAL STRICTURE OF THE URETER

Report of Four Cases[1]

By HERMAN L. KRETSCHMER, M.D., F.A.C.S., Chicago

NO subject is receiving as much discussion and no subject occupies the center of the urological stage so prominently as does the subject of stricture of the ureter in adults. This is due primarily to the enthusiasm and untiring work of Hunner, who by his many contributions has aroused the interest of urologists in all parts of the country. By reason of the widespread interest and the ample opportunity to study this lesion, it will not be very long before the entire subject of stricture of the ureter, in adults, will be upon a firm basis and become so well stabilized that many of the disputed and doubtful questions will be cleared up.

Congenital strictures, or so-called congenital strictures, it should be emphasized, are not so easy to study and the cases are apparently not so numerous as are the ordinary cases of stricture of the ureter. As can readily be understood, the cases occur in children, and they are not referred to the urologist for study. Moreover, the condition is often not recognized, and it is necessary to use the cystoscope and to make pyelograms in all cases, for which the consent and co-operation of the parents are very difficult to obtain.

There is today in the literature on this subject, a great deal of confusion and a lack of clarity in the description and case reports. A perusal of the literature shows that many cases are reported as cases of congenital stricture and no reason or reasons are given by the author or authors that they are reporting a case of congenital origin. It is difficult to understand by what method of reasoning a case of stricture of the ureter with a hydroureter and hydronephrosis occurring in an adult of 30, 40, 50, or even 60 years, should be classed as a case of congenital stricture. The classification of many of the cases of so-called congenital stricture of the ureter surely needs revision, particularly that group which has been classed as congenital and reported late in life.

The arbitrary age of 5 has been selected by some who believe that all these cases manifest themselves before the age of 5. Whether or not this is true remains to be seen.

On account of the arbitrary classification in the literature, it is with some hesitation that I venture to report 4 cases of so-called congenital stricture of the ureter, the oldest patient being 5 years of age and the youngest 7 months.

The etiology is obscure and difficult to determine. As is well known, the ureter early in embryonic life consists of a solid mass of epithelial cells, which later undergo canalization to form the lumen. If there is interference with this process, obstruction may result. Whether or not this would go on to true stricture formation or whether these cases are the result of an intra-uterine infection, I am not prepared to say, for the question of intra-uterine infection is one that has not as yet been definitely determined. Are these strictures acquired through some sort of infection other than intra-uterine? This, indeed, would be difficult to demonstrate.

Case 1. R. E., male, age 7 months, was referred by Dr. John De Witt, of Canton, Ohio.

The present complaint was swelling of the right side of the abdomen, which had been present for 5 months. When the patient was *2 months old* the mother noticed that the right side of the abdomen was much larger than the left side. As there were no untoward symptoms, the mother dismissed the matter from her mind, thinking that her imagination was to blame. However, on several occasions during the next 2 or 3 months she again noticed this swelling. One month ago, on account of the increasing size of the swelling, a physician was consulted. The patient had had attacks of fever on several occasions during the past month.

The patient had been delivered normally. According to the mother's statement, the baby did not cry nor fret more than any normal child.

Physical examination. The patient was a slightly emaciated, somewhat anæmic-appearing child lying quietly in bed. Examination of the abdomen showed the presence of an enormous swelling in the right upper quadrant of the abdomen. It was relatively smooth, soft, and mobile. Examination of the mass

[1] Read before the Association of Genito-Urinary Surgeons, Washington, May 5-6, 1925.

did not produce pain. During the examination the mother made the statement that the tumor was much larger the night before they left home but that after the child arrived in the hospital it had decreased in size.

X-ray examination was negative for stone. The kidney outlines could not be determined.

Examination of blood showed whites 13,000; hæmoglobin 80 per cent.

Blood chemistry: Urea, 40; uric acid, 3.5; creatinin, 1.15; non-protein nitrogen, 38.

Cystoscopic examination, November 13, 1923, showed that the bladder was normal. The right ureteral orifice was seen and was normal in appearance. The left ureteral orifice was not found.

The second cystoscopic examination (November 26, 1923) was done after an injection of indigo-carmin was made to aid in locating the left ureteral orifice. The left ureteral orifice was not found. The right ureter was not catheterized, our object being to catheterize the left kidney in order to study its function, because of the fact that a right nephrectomy was planned. There was no elimination of the indigo-carmin from the bladder at the end of 50 minutes' observation in the cystoscopic room. The urine voided 6½ hours after cystoscopic examination was pale blue. Urinalyses showed the urine cloudy; acid; albumin and pus present; no blood or sugar. Cultures were sterile.

A diagnosis of right hydronephrosis was made and operation advised. In view of the fact that no ureter was found on the left side, the thought occurred that perhaps there was a double kidney with but a single ureter, opening on the right side. The possibility that the patient had either a solitary kidney or a solitary cyst was also considered.

Operation, November 30, 1923, was performed under nitrous oxide ether anæsthesia, the usual oblique kidney incision was made. Examination showed a large hydronephrotic kidney. The pelvis was greatly dilated and was the size of a large grapefruit. Because of the large size of the hydronephrotic kidney, it was impossible to deliver it through the wound. Examination showed the presence of a stricture of the ureter about 1 centimeter below the kidney pelvis. The tumor was aspirated and 600 centimeters of cloudy fluid obtained. An incision was made into the kidney. A probe was passed through the ureter and the stricture dilated. The kidney parenchyma was sutured with catgut around a rubber tube. A nephrotomy not a nephrectomy was done, because there was no proof of the presence of a normal kidney on the opposite side. Exploration of the left kidney area, through the incision, made in order to demonstrate the presence of a left kidney, was unsatisfactory in that no left kidney was felt. For this reason, together with the fact that no ureter was found at cystoscopy, a nephrectomy on the right side was not done, which, as subsequent events proved, was a blessing.

Postoperative course. After the operation the patient never voided a drop of urine from the bladder, the urine being passed through the opening in the loin. Recovery from the operation was uneventful. Patient lived from November 30, the day of operation, until December 14.

Autopsy was performed by Dr. Oberhelman. The anatomical diagnosis was as follows: Bilateral hydronephrosis; bilateral stricture of the ureter; bilateral suppurative nephritis; hyperplasia of the periaortic abdominal lymph glands; cloudy swelling of the liver; fibrous adhesions between the spleen and parietal peritoneum, and pancreas and left kidney. Examination of the bladder, prostate, and seminal vesicles, was negative.

Right kidney: The posterior surface of the right kidney was covered with exudate and had adherent to it perirenal fat and fibrous and fibrinous adhesions. The kidney was enlarged and the pelvis dilated but collapsed. The junction of the pelvis with the ureter was very narrow and when measured across was only about one-third the diameter of the rest of the ureter. The ureter below this point was normal; not enlarged.

Left kidney: The gray fat which surrounded the kidney was adherent in many places and when an attempt was made to separate it a small amount of pus was seen outside the kidney. The kidney was pale yellow and stippled with hæmorrhages. The pelvis was markedly dilated and its junction with the ureter formed a large pointed projection. The junction was very small and the proximal 4 centimeters of the ureter were directed straight up and adherent to the outside of the pelvis (Fig. 1) where the ureter made a sharp turn and descended into the pelvis. The left adrenal was adherent to the outside of the kidney. The blood supply was normal. The ureter below the point of stricture was not dilated and its entrance into the urinary bladder was not obstructed.

This patient had a bilateral stricture and bilateral hydronephrosis that had caused complete destruction of the left kidney, as evidenced clinically by the fact that no urine was ever excreted from it. As previously mentioned, all the urine drained out of the drainage tube from the right kidney. An attempt to locate the left kidney at the time of operation on the right side failed to demonstrate the presence of a kidney. Undoubtedly this was due to the fact that only a shell of kidney remained, and hence could not be felt. This little patient was evidently living on a very small remnant of kidney tissue present on the right side.

CASE 2. J. P. R. male, age 5 years, was referred by Dr. Thor Jager, Wichita, Kansas. This child was delivered normally; breast-fed for 8 months; and walked and talked at 1 year. The patient had measles at the age of 1; chicken-pox at the age of 2½; and a temporary enlargement of the glands of the neck the winter prior to coming under observation.

From early infancy he was subject to attacks of colic. At the age of 1½ years he had definite attacks of pain in the abdomen and at the age of 3½

developed the present attacks which have persisted. They occurred on an average of once a week and lasted for about 2 days. In the interval the child was perfectly well. The attacks became much worse with increased frequency. The pain, very severe in character and associated with nausea and vomiting, was located chiefly in the upper left quadrant of the abdomen. During attacks the patient's temperature rose to 103 degrees. Examination of the urine in an attack, 6 months previously, showed blood and pus. Because of recurring attacks of chills and fever associated with pus in the urine, the child had been treated for acute pyelitis before he was seen by Dr. Jager.

General physical examination showed the head, neck, and chest to be normal. Examination of abdomen revealed a very large tumor mass in left upper quadrant, the size of a large grapefruit, not tender, and freely movable. The genitals were negative. Examination of the blood showed leucocytes 8,400; hæmoglobin 92 per cent.

Cystoscopic examination on February 24, 1923, showed the bladder normal, and the ureteral openings normal. Both ureters were catheterized without difficulty or obstruction. From the left kidney a prompt flow of very turbid urine was obtained. The right urine was clear. The catheterized urines were as follows:

	Leucocytes per cubic millimeter	Culture	Tubercle bacilli stains	Urea
Bladder	62	Sterile	Negative	1.5 per cent
Right kidney	49	Sterile	Negative	1.3 per cent
Left kidney	11,200	Sterile	Negative	.1 per cent

PHENOLSULPHONEPHTHALEIN TEST

	Right	Left
Appeared in	5 minutes	No thalein from left side
First 30 minutes	12.5 per cent	
Second 30 minutes	19. per cent	
Total of 1 hour	31.5 per cent	

Examination by Dr. Grulee revealed a soft systolic murmur over the apex, which he thought was an adventitious murmur.

Blood chemistry showed urea, 38; uric acid, 2.8; creatinin, 1.1; non-protein nitrogen, 30.

A pyelogram of the left side showed the catheter extending to the fourth lumbar spine, then making an abrupt lateral curve to the left, and stopping about 2 inches from the spine. A film made while the tumor mass was being pushed mesially showed the kink in the catheter overlying the lumbar spine and the tumor mass pushed considerably toward the midline. The pyelogram showed a large, round shadow that extended from the twelfth rib above to the lower border of the fourth lumbar vertebra below, and from the middle of the spine to a line drawn from the tip of the eleventh rib to the crest of the ilium. There was an enormous dilatation of the kidney pelvis and enormously enlarged, clubbed calyces. The kidney pelvis measured 8.5 by 9.5 centimeters. Each of the calyces was approximately 3 centimeters in diameter and five were shown (Fig. 2).

A diagnosis of hydronephrosis, due to stricture, was made.

At operation, March 6, 1923, under general anæsthesia, a left lumbar nephrectomy was performed. The usual oblique lumbar incision was made and the kidney delivered without difficulty. The pelvis was enormously enlarged. At the ureteropelvic junction a stricture of the ureter was found. The vascular pedicle was ligated and cut and the ureter was ligated and divided and removed below the point of stricture. The postoperative course was uneventful.

Description of specimen. The kidney and empty pelvis weighed 52 grams. The kidney was 9 by 3.5 by 2.5 centimeters. The collapsed pelvis was 5 by 4 centimeters. The capsule of the kidney had been stripped off and the surface was red, finely granular, and also showed marked *fetal lobulations*. The pelvis was attached to the kidney along the entire length of the concave surface; it was thin-walled and white, and the ureter rose abruptly at its lower distal and anterior aspects. There was a distinct stricture 5 centimeters below the origin of the ureter. The average diameter of the ureter was 3 millimeters while that of the stricture was 1 millimeter. Two arteries and a vein entered the kidney anterior to the pelvis at the juncture of the upper and middle two-thirds. No aberrant vessels were present. On opening the ureter and pelvis we found the lining throughout smooth, glistening, and shining. There were no areas of leucoplakia. A septum at the level of the large vessels partially divided the pelvis into upper and lower cavities. The walls were uniformly 1 millimeter thick. Section of the kidney showed greatly dilated calyces and thinning of kidney tissue. The average thickness of kidney tissue was 5 millimeters, half of which was medulla and half cortex (Fig. 3).

Microscopic examination showed generalized infiltration of the kidney substance with round cells and polymorphonuclear lymphocytes with areas of fibrous tissue replacement. The sections of the wall of the pelvis were in relatively normal condition except for slight round-celled infiltration.

CASE 3. T. H., male, age 3 years, was referred by Dr. B. W. Sippy. At the age of 22 months the patient was suddenly seized with chills and fever, the attack lasting about 1 week. Temperature at the time had varied between 104 and 105 degrees F. There were frequent vomiting spells. Several months later there was a recurrence of the attack which was followed by a swelling on the right side in the region of the right kidney. This was incised and drained and a large quantity of pus was evacuated. Frequency of urination began after the operation, voiding being peremptory every 2 or 3 hours at night. There was pus in the urine. At the time of operation a tube was inserted into the kidney, and so long as the tube was in no urine was passed from

the bladder. The father had been told that the boy had only one kidney.

It may be possible that the boy had a bilateral condition and a status similar to that presented in Case 1.

Examination revealed a scar on the right side in the right lumbar region with some tenderness.

Examination of blood showed 14,000 leucocytes. The X-ray was negative for stone.

Cystoscopic examination, September 17, 1921, showed a normal bladder, with left ureter absent. Two subsequent ureteral catheterizations failed to show the presence of a left ureteral orifice. Under anæsthesia the results were no better. The right ureter was catheterized and a pyelogram made (Fig. 4).

Examination of the urine obtained at the cystoscopic examination was as follows:

	Cells	Culture
Bladder	720	Staphylococcus albus
Right kidney	480	Staphylococcus albus
Left kidney	Not catheterized	

The pyelogram showed an enormously dilated ureter, enormously dilated kidney pelvis, and very much enlarged superior and inferior calyces. The fluid in the ureter terminated very abruptly opposite the upper margin of the hip joint. From these findings a diagnosis of stricture of the ureter with an infected hydro-ureter and hydronephrosis was made.

Case 4. M. M., female, age 7 months. Shortly before coming under observation the patient had had an attack of influenza, so-called, after which pus was present, more or less, in the urine. The gastro-intestinal symptoms had manifested themselves in 4 or 5 bowel movements a day. Digestion was poor. The temperature rose as high as 103 degrees. Culture of the urine revealed pure culture of bacillus coli communis. Treatment had consisted of bicarbonate of soda, sodium citrate, and vaccines, but the improvement was only temporary. There had been recurrent attacks of fever, nausea and vomiting the temperature rising to 103 degrees F.

The physical examination was negative.

Cystoscopic examination, October 24, 1919, showed some œdema at the base of the bladder and trigone, the ureteral orifices normal, and a few small cysts in the bladder. The passage of a catheter up the left ureter met with some obstruction.

Urinalysis of urines obtained by ureteral catheters showed a few pus cells, and cultures were positive for bacillus coli. Stained sediment was negative for tubercle bacilli.

Pyelograms were made which showed a marked degree of enlargement of the right kidney pelvis, with clubbing of the calyces and broadening of their bases. The pyelogram on the left side showed only a moderate amount of enlargement of the pelvis.

The interesting phase of this subject, aside from the etiology, concerns itself with the problem of the early diagnosis so that the proper form of treatment may be instituted. That this lesion is not so rare as one would be inclined to think, is evidenced by the fact that Bottomley, in his very extensive monograph on this subject was able to collect 25 cases that occurred in children under the age of 5. His cases were nearly all autopsy cases and while a few of these patients died from intercurrent diseases, most of them died as the result of the urinary tract lesion.

Bugbee, who recently reported a large series of congenital anomalies of infancy and childhood, affirms, as the result of his investigations, that less than one-third of the infants who had hydronephrosis lived over 6 months.

The gravity of the lesion of course is less severe when it occurs only on one side, but a review, for example, of Bottomley's cases, shows that out of 22 cases, 5 were bilateral. One case in my series of 4 was bilateral.

There seems to be but little difference in the frequency with which the right or left side is involved. And the same statement may be made regarding the frequency of occurrence in sexes. There is so little difference in the figures of diagnostic moment that one obtains little help from these factors.

A number of cases are reported in the literature but they are autopsy reports. Evidently during life the symptoms did not lead the clinician to suspect a congenital stricture of the ureter. Even in those instances in which there is mention of the symptoms, the fact stands out that the clinician did not focus his attention on the higher urinary tract, but was in a state of doubt as to the real cause of the disturbance, and was more or less mystified as to the cause of death.

Another fact to be borne in mind is that most of the cases were reported in the older literature at a time when these little patients were not given the benefit of a careful and complete urological survey. Even today the problem with which urologists have to contend is the lack of opportunity given them to examine these patients carefully, and the result is that the patients come to autopsy all too frequently without a clear determination of the exact pathology present. It is not difficult to understand just why this should be

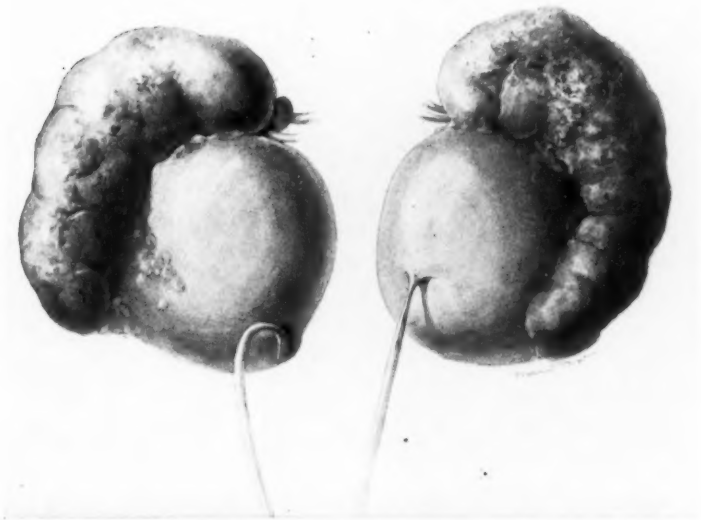

Fig. 1. Case 1. Showing the presence of bilateral stricture with resulting dilatation of both pelves and hydronephrosis. The ureter on the left side, below the stricture, was firmly adherent to the dilated pelvis.

the case when the symptoms point but vaguely to stricture of the ureter or when lesions of the urinary tract are suspected. Surely, the only measure that will result in a correct diagnosis is a complete urological examination. That the clinical picture is not always typical and the symptoms at times are those of acute infection, are points in favor of a thorough urological examination. In 2 of the cases reported here the treatment was the ordinary one for acute pyelitis.

BILATERAL STRICTURES

According to Mufson only 8 cases of bilateral congenital stricture have been reported, to which he adds 1 of his own. Wason has recently reported a case of bilateral stricture in a male 7 months of age. Doubtless, as this subject receives more careful consideration and these cases are observed more closely, a larger number, not only of single but of double strictures will be reported.

One of the patients in this group (Case 1) had bilateral strictures which were found at autopsy, the condition (bilateral) not having been recognized clinically.

Case 3 in which we were never able to find a left ureter, and in which no urine came through the bladder when the kidney on the opposite side was drained, would suggest the probability that the patient had bilateral strictures, one of which had completely closed, causing complete destruction of the kidney, a condition which occurred in Case 1 in this series.

In one of the cases the patient was sent in because of the presence of a large abdominal tumor, with a tentative diagnosis of tumor of the kidney, probably malignant. In the remaining cases, because of chills, fever, and pus in the urine, the patients were sent in with a diagnosis of acute pyelitis.

Doubtless an attack of acute pyelitis may mask some of these cases of so-called congenital stricture of the ureter, and it might be interesting to study a large series of cases of pyelitis which come to autopsy to determine whether or not they were simple cases of pyelitis or cases of congenital stricture. In other words, would one in this way pick up more cases if one followed all cases of acute pyelitis to the autopsy table? There is no

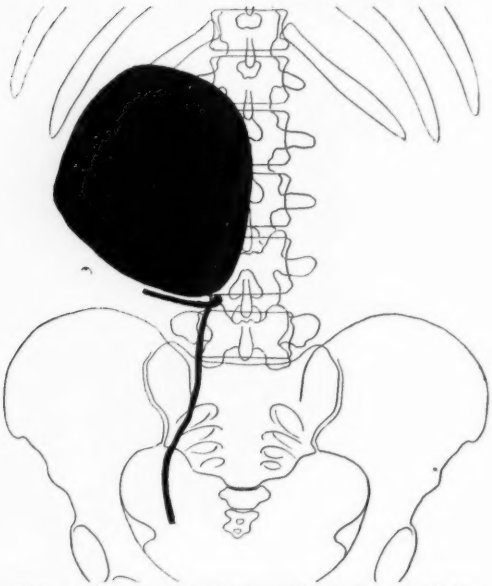

Fig. 2. Case 2. Large hydronephrosis due to stricture at the ureteropelvic junction extending from the top of the eleventh rib to the fourth lumbar vertebra. Note course of the ureter.

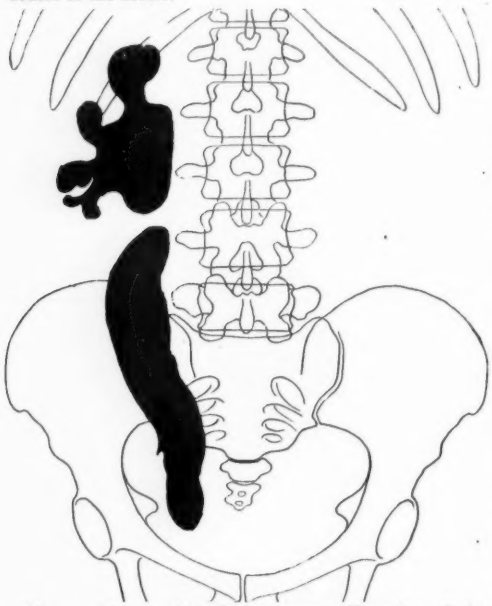

Fig. 4. Case 3. Showing enormous dilatation of the ureter, with a large hydronephrosis due to stricture at the ureterovesical junction.

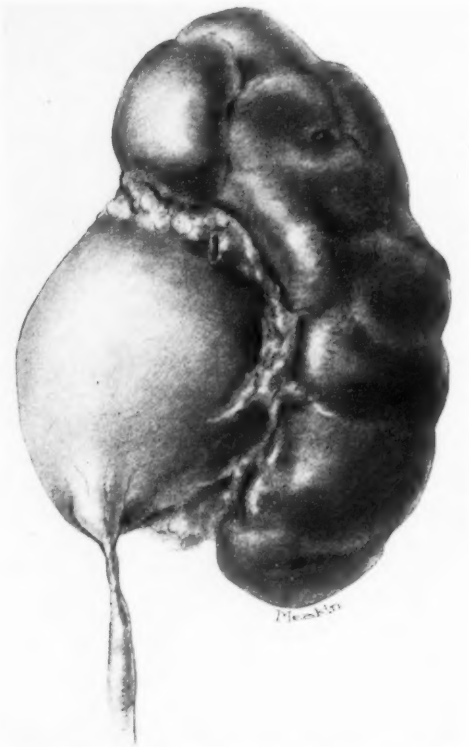

Fig. 3. Case 2. Showing the presence of a stricture below the ureteropelvic junction, with a resulting dilatation of the kidney pelvis and a hydronephrosis.

doubt that some of these patients whose cases end fatally during attacks of acute pyelitis may have been suffering from an infected hydronephrosis secondary to stricture of the ureter. Occasionally there is a very sudden and stormy onset so that the condition is confused with the so-called surgical abdomen and an operation for acute appendicitis is performed. So long as the hydronephrosis remains uninfected and a palpable tumor is not found, the condition is not suspected. When the hydronephrosis remains stationary and does not become infected, the clinical course is afebrile. In case a tumor is present and varies in size, as occurred in one of these cases, the diagnosis should be relatively easy. The condition has also been confused with malignant renal tumor.

The problem of diagnosis was interesting in Kahn's case, in which the diagnosis was obscured by a history of intestinal obstruction. A megacolon had to be taken into consideration as well as a tuberculous peritonitis.

It should be emphasized that urinary findings may give no intimation of the condition present in the kidneys. Another point of importance to remember is that absence of symptoms pointing to the ureter as the source of the trouble, especially in acute cases, makes a definite diagnosis of ureteral stricture at times very difficult before operation.

Because of the relative frequency of bilateral lesions, the data on the opposite kidney should be carefully looked into. It would have been very easy and very simple in case I had carried out a nephrectomy which doubtless would have shortened the patient's life.

BIBLIOGRAPHY

BOTTOMLEY. Ann. Surg., 1910, lii, 597.
BUGBEE. J. Am. M. Ass., 1924, 237.
KAHN. Med. Rec., 1912, lxxxii, 895.
MUFSON. Proc. New York Path. Soc., 1919, xix, 66.
WASON. J. Urol., 1920, iv, 123.

A NEW AND SIMPLE REPAIR OF RUPTURED OR STRICTURED URETERS[1]

BY L. L. McARTHUR, M.D., F.A.C.S., CHICAGO

AS I have demonstrated since 1907, with increasing satisfaction to myself and my patients, the feasibility of restoring the integrity of the common bile duct together with its function, when portions were missing or strictured, I have been watching for years for an opportunity to apply the same principles to other excretory ducts such as the ureter, urethra, and salivary duct. Finally, in April, 1923, I used the method here presented with such gratifying results that I feel justified in inviting your attention to the case in question, the X-ray findings, and the method which, once clearly understood, will appeal to you as worthy of trial.

If, in an active surgical service of two of our largest hospitals, one has to wait over 10 years for an appropriate case, it will be readily seen that no one surgeon could report a series; in fact, Morris could collect but 24 cases of traumatic rupture of the ureter in the literature. However, should such a case come to one of you, the knowledge that there still remains a recourse, simple of performance and of *demonstrated* value, should prove a source of mental comfort. To the patient it will mean the salvation of a kidney sacrificed at present to avoid a permanent urinary fistula.

SUMMARY OF CASE

August 28, 1922, the patient was knocked from a wagon seat by a collision, and the left side of the body struck a stone curbing. X-ray pictures taken when he arrived at the hospital revealed fracture of the left three lower ribs, and the left transverse processes of the second and third lumbar vertebræ. Shortly after the accident, he developed a severe constant pain in the left renal region, a gradually enlarging tumor mass in the left side. These two symptoms persisted until November 19, 1922, when he was operated upon at the Masonic Hospital, Chicago. He was told he had had "water on the kidney" and that 2 quarts had been evacuated. Since then, there had been a persistent urinary fistula, with free flow of urine saturating heavy dressings twice daily. When he was admitted to St. Luke's, the physical examination was negative except for a palpable mass in the left kidney region, and a fistula. A ureteral catheter on the left side met with resistance at 4 centimeters from the ureteral orifice.

The X-ray showed the fractures mentioned and a tumor shadow (kidney?).

The laboratory reported the urine negative; red and white corpuscles and hæmoglobin normal; and phenolphthalein output from the right kidney 50 per cent in 2 hours. No Wassermann was made.

Diagnosis. Obstructed ureter and urinary renal fistula.

Operation. April 20, 1923, by L. L. McArthur, at a Clinic given for the visiting Detroit Surgical Society. Reopening the former renal incision, the kidney was found rigidly fixed by the prolonged and excessive infiltration with a fibrosis of fatty capsule,

Read before the Western Surgical Association, December 4-6, 1924.

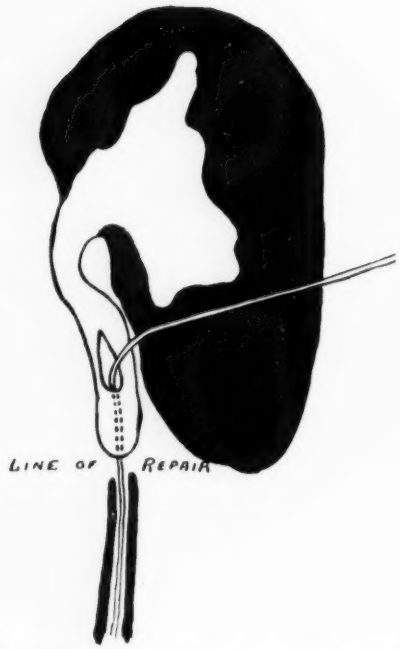

Fig. 1. A schematic drawing of the repair of the case reported.

Fig. 2. Actual position of the catheters in the patient, as shown by X-ray.

so that attempts to bring the kidney to the surface were abandoned. Attention was then directed to the ureteral outlet. Just below the lower pole, a translucent, fluctuating tubular structure was found, of lead pencil size, 2 inches long, terminating in a blunt extremity. Believing this to be a distended ureter, a longitudinal incision was made in its side, clear urine escaped, followed by cloudy mucopurulent fluid, and a flexible probe was readily passed into the renal pelvis. After considerable search, the distal end of the same ureter was found, very atrophic after 9 months non-use but admitting a ureteral catheter, which could be passed its full length into the bladder. The ends of the ruptured ureter, which had evidently been severed by the force that fractured the second and third lumbar transverse processes, could be approximated to within 1 inch of one another.

The situation and findings were stated to the visiting surgeons present and counsel asked. The sole recommendation offered was *immediate nephrectomy*. I then proposed to them trying the technique by which common duct repair had proved successful, but met no encouragement. The ends of the ureters were resected sufficiently to remove scar tissue. Through the longitudinal slit in the side of the proximal fragment of the ureter an ordinary soft rubber No. 6 urethral catheter was passed well up into the pelvis of the kidney and its free end brought out through the wound to the surface of the body. Through the same longitudinal slit in the side of the proximal fragment of the ureter, the tip of a fair-sized ureteral catheter was passed downward, out of the freshened end, and then on into the freshened end of the distal fragment down well into the bladder, its free funnel end also being brought out of the wound beside the catheter. The gap between the ureteral ends diminished by sutures to about ¾ inch. Both catheters were fixed by sutures to the lumbar skin edges and the wound closed. Drainage of the kidney was so perfect that the hydronephrosis disappeared. The urine from the left kidney collected in a rubber glove into which renal drain was tied, during 9 weeks was normal after first week, and abundant. At the end of 9 weeks both catheters were removed. There was no further escape of urine. The wound immediately healed. The quantity of vesical urinary output doubled at once. The patient was shown to the Chicago Surgical Society 9 months later, perfectly well objectively and subjectively, with no pain and no recurrence of the tumor. The patient was still in perfect health when she was examined November 17, 1924.

TECHNIQUE

Given a missing portion of a ureter, even 1 to 2 inches in length, a longitudinal slit is made in the side of the *proximal* portion sufficiently long to admit two catheters. One of these, a rubber urethral catheter, is inserted upward to the renal pelvis; the second, a *ureteral* catheter of good size, is inserted downward so that it passes out of the proximal end, and bridges the gap to the proximal end of the distal remaining ureter. Both ends of the ureters are then approximated as closely as feasible by absorbable stitches. The catheters are then brought to the surface and permanently secured to the skin by stitches or other devices. All the urine from that kidney is thus diverted from the field of operation during the time of epithelization. The body tissues heal together around the catheter, bridging the gap between the renal end and vesicle end, and the catheter simply remains *in situ* until in the judgment of the operator an epithelial lining has had time to grow between the ends. No experimental work along these lines has determined the *time* element; but that epithelization *does* occur has been amply demonstrated in the various reconstruction methods that have proved successful. We owe much to Strauss for a method of securing epithelization. Thus, in the specimens of Strauss (tubular fascial grafts) the epithelium is plainly to be seen, though of the flat pavement variety. Knowing that fascial tubes would thus become lined with epithelium, I thought epithelization would occur equally well without transplants provided I maintained a tunnel long enough for epithelium to grow from each end to line it, and for the primary inflammatory reaction and contraction to subside. I could then withdraw the catheters from both ends and have a channel lined with epithelium that would permit the flow of urine. This had proved successful with several common ducts and has now been demonstrated as similarly efficient for ureters.

Whether the missing portion of the ureter is lacking by accident or design (as because of malignant disease), when the ureter is too short to be implanted in the bladder, the above technique can be applied with safety and success.

PNEUMONOGRAPHY[1]

By LOUIS H. CLERF, M.D., Philadelphia
From the Bronchoscopic Clinic, Philadelphia

EVER since 1905, when Chevalier Jackson first used a radiopaque substance for outlining the tracheobronchial tree, the value of pneumonography as a diagnostic aid, has steadily advanced. The rapid progress made in the field of roentgenology during the past decade has contributed immensely to correct diagnosis and localization in diseases of the lungs. In certain cases, however, a correct interpretation of the roentgen-ray findings is difficult without resorting to pneumonography, that is, increasing the visibility of the tracheobronchial tree by the intrabronchial introduction of a material which is opaque to the roentgen-ray.

In 1905, Chevalier Jackson conducted a series of experiments on the use of radiopaque substances in the air passages and presented some of his results before the Pittsburgh Academy of Medicine (personal communication). Later (1907) he recommended its use for purposes of orientation of certain diseases of the lungs stating that "a radiogram may be taken after blowing bismuth oxide through a dry, extra drainage tube" (1). He subsequently reported the use of this method of lung mapping (2) in a large number of cases for the radiographic localization of foreign bodies and of bronchiectatic and abscess cavities without any harmful effects to the patients.

Coincident with this work it was observed in the use of radiopaque mixtures in the roentgen-ray diagnosis of œsophageal disease that accidental aspiration of these substances into the air passages occurred not infrequently.

Beeler (3) reported a case of accidental aspiration of a barium mixture.

Stewart (4) discovered a case of œsophagotracheal fistula in which a quantity of bismuth mixture was aspirated directly into the trachea. He later found three additional cases. Accidental aspiration while swallowing bismuth or barium solution has since been repeatedly observed, occurring more often in patients with cancer of the upper œsophagus especially when associated with paralysis of the recurrent laryngeal nerves. These accidents are usually unattended with any systemic reaction.

Radiopaque substances used. In order to carry out pneumonography successfully as an aid to the roentgenologist it is necessary to use an agent which is opaque to the roentgen-ray, is capable of being introduced into the air passages and when so introduced will prove harmless to the patient. Many substances have been tried with various results. The subnitrate and subcarbonate of bismuth are the most commonly used powders and are considered as being harmless; however under the influence of certain bacteria the subnitrate is capable of giving off nitrites and nitric acid thereby rendering it not absolutely free from danger. The writer experimented with barium sulphate, insufflated into the air passages of dogs, with a view of comparing its efficacy with the bismuth salts.[2] It was found to possess no advantages over the latter, in fact it formed lumps more readily thus interfering seriously with its insufflation. Since its atomic weight is less than bismuth it is less opaque to the roentgen-ray and so is less desirable than bismuth.

In addition to its use as a powder, bismuth has been used in liquid form. The late H. L. Lynah (4) collaborating with W. H. Stewart, used bismuth in aqueous and oily solutions injecting the mixture directly into abscess cavities. Not only did the methods furnish excellent data for purposes of localization but it also exerted a highly satisfactory therapeutic effect. The bismuth was used in pure olive oil in proportion of 1 to 2 and was boiled before using. After injection, the emulsion would remain in the cavities from several weeks to as long as 2 months.

Lipiodol, a vegetable oil containing 40 per cent by weight of iodine, first used by

[2] Through the courtesy of Dr. J. E. Sweet, professor of surgery, Graduate School of Medicine, University of Pennsylvania, in whose laboratories the work was conducted.

[1] Read before the American Laryngological, Rhinological, and Otological Society at Atlantic City, May 22, 1925.

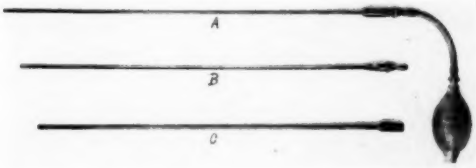

Fig. 1. The Clerf bronchoscopic powder insufflator used for endobronchial introduction of opaque powders in pneumonography. The insufflator, A, consists of a hollow outer tube or cylinder, *C*, fitted with a removable gutter-shaped carrier, *B*, which extends throughout the full length of the cylinder, *C*. The powder carrier, fitted with a cone-shaped end, fits accurately into the sleeve of the outer tube. To fill, the powder is loosely scattered throughout its entire length. It is then inserted into the cylinder and rotated to dump the powder in a long loose ridge.

Sicard for the localization of spinal cord tumors, has been extensively employed by Sergent and Cottenot (5), Atmand-DeLille and Moncrieff (6) and others for the diagnosis of bronchial and pulmonary affections. The method employed by them consists of the injection of a quantity of the oily solution with a syringe through a small tracheal cannula which had previously been inserted

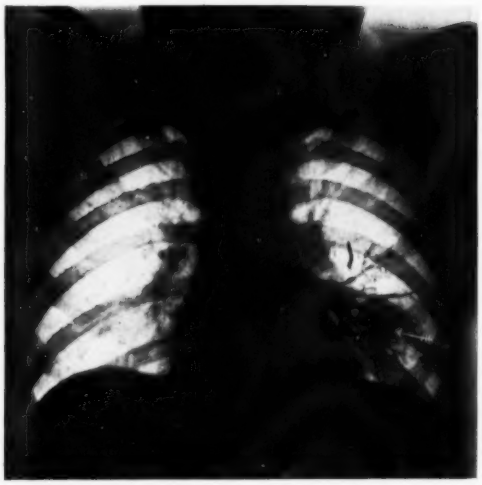

Fig. 2. Pneumonogram made by Dr. John T. Farrel. Patient was a man, aged 26 years, who had a penetrating foreign body in the left lower lobe. The advisability of bronchoscopic removal by penetration of the bronchial wall as practiced by Chevalier Jackson was decided against and external surgery was advised, after localization of the fragment of shrapnel in relation to the adjacent branches of the lower lobe bronchus. Dr. W. F. Manges reported that the large fragment, because of its size, could not be brought up through the bronchus.

Fig. 3. Roentgenogram of a man, 20 years of age who gave an indefinite history of aspirating a small button. Dr. Leon Solis Cohen reported a small shadow in the right lower lobe which suggested foreign body but did not correspond accurately to the usual position of the larger bronchi in that locality. After the bronchoscopic insufflation of bismuth subcarbonate Dr. Cohen reported that the suspected shadow was clearly in the parenchymal tissues and was undoubtedly a calcareous deposit.

Fig. 4. Roentgenogram made in the case of a man, aged 32 years, who had a lung abscess involving the right lower lobe. Films were taken by Dr. John T. Farrell after the bronchoscopic instillation of twelve cubic centimeters of lipiodol into the bronchial branch draining the abscess cavity. Dr. W. F. Manges reported that the abscess cavity was well filled and a small quantity of the opaque material was present in the terminal branches of the right lower lobe.

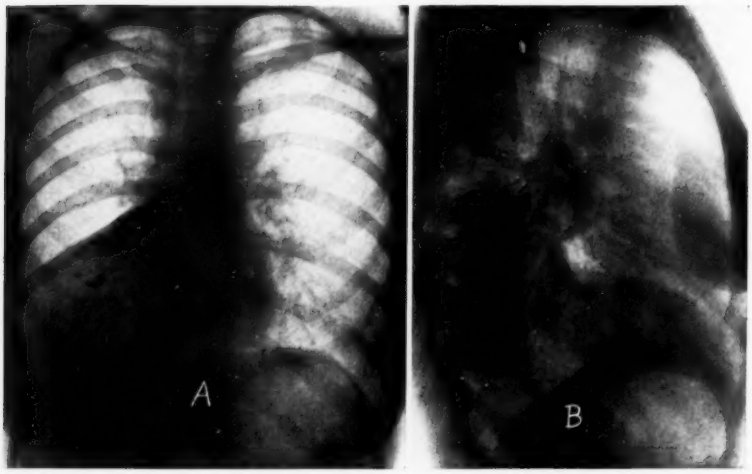

Fig. 5. Extensive bronchiectasis involving the right lower lobe in the case of a girl, aged 17 years. Pneumonograms were made by Dr. John T. Farrell after the bronchoscopic instillation of 20 cubic centimeters of lipiodol. Dr. W. F. Manges reported that there was marked fibrosis of the entire right lower lobe and that all of the bronchi were dilated even to the terminal branches. The anteroposterior view, *A*, shows the uniform dilatation of the bronchi down to the level of the diaphragm. The lateral view, *B*, demonstrates the marked decrease in the size of the lower lobe.

into the trachea through the cricothyroid membrane under local anæsthesia. By turning the patient to one or the other side, the oil can be made to run into the corresponding bronchi desired. As soon as the injection is completed the cannula is withdrawn and radiograms are immediately taken. The oil casts a heavy shadow on the ray plate, consequently abscess cavities, bronchial dilatations and other pathology are clearly outlined.

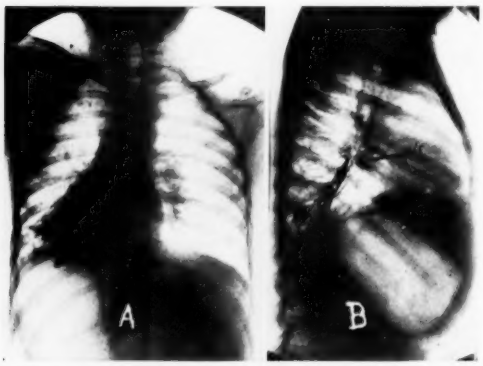

Fig. 6. Pneumonograms made by Dr. Leon Solis Cohen in a case of bronchiectasis of the left lower lobe with a cicatricial stricture of the bronchus. Bismuth subcarbonate was insufflated by Dr. R. M. Lukens. The anteroposterior view, *A*, shows marked dilatation of the bronchi of the left lower lobe. The bronchial stricture (indicated by arrow) is clearly shown in the lateral view, *B*. In spite of the narrowed bronchial lumen which interfered with drainage from the lower lobe, no trace of bismuth was found in the roentgenogram made of the chest 24 hours after the insufflation.

In addition to using lipiodol, the author has tried various other solutions, notably aqueous solutions of sodium bromide and sodium iodide. Although successful in a few cases it was found that aqueous solutions are not well tolerated by the tracheobronchial mucosa. The iodide and bromide of sodium did not produce any deleterious local or systemic reaction; however, they were sufficiently irritating to excite the cough reflex so that but an occasional patient was able to retain the solution a sufficiently long time to permit of the necessary roentgenographic studies. Lynah tried thorium with apparently unsatisfactory results.

The methods of choice are the insufflation of dry bismuth subcarbonate or the injection of lipiodol and these are now used exclusively at the Bronchoscopic Clinic.

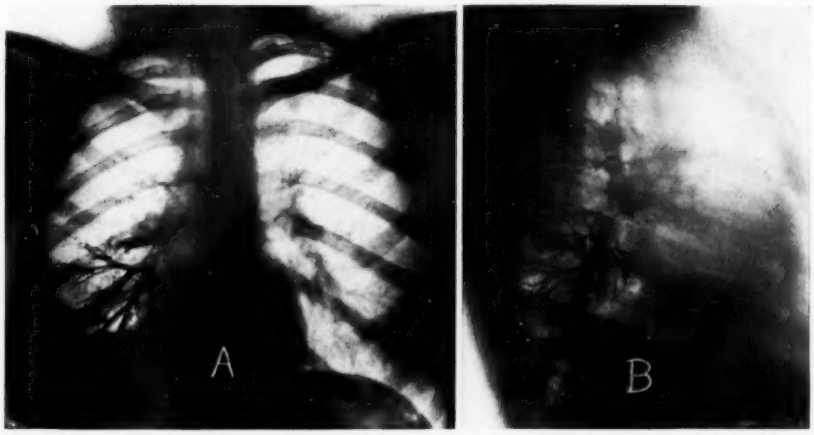

Fig. 7. Anteroposterior and lateral pneumonograms of a patient, aged 15 years, who was referred to the Bronchoscopic Clinic by Dr. Edward Weiss from Professor Solomon Solis Cohen's service of the Jefferson Hospital. There was a history of an old right-sided empyema which had been drained externally. The findings on admission were suggestive of a fistulous communication between a bronchus and the old empyema cavity. Bismuth subcarbonate was insufflated to determine whether the present pathological process was confined to the pleural cavity or if there was a bronchopleural fistula. Dr. W. F. Manges reported that the pathology at the costophrenic angle on the right side was almost entirely in the pleura and he was unable to demonstrate any evidence of a fistula.

TECHNIQUE

Bismuth subcarbonate should be dry and free from lumps. In addition it should be sterile. The application of dry heat tends to break up some of the subcarbonate into a carbonate and also increases its tendency to form small lumps. The insufflation is best carried out bronchoscopically using the author's bronchoscopic insufflator (Fig. 1). With the Jackson bronchoscope inserted through the mouth into the bronchus or opposite the orifice of the bronchus to be mapped out, the filled insufflator is introduced through the bronchoscope and its contents blown out with the aid of a hand bulb during deep inspiration. This method permits of the mapping of a limited portion of the lung. A specially devised powder blower to be used with the positive pressure apparatus was tried but did not prove satisfactory because of the physical characteristics of the powder and its too widespread distribution.

Lipiodol can be very readily injected through a Jackson aspirating tube which is introduced through a previously inserted bronchoscope and passed into the bronchus to be outlined. At the Bronchoscopic Clinic this method of bronchoscopic instillation is used in preference to the injection through an intratracheal cannula, since it permits of a more definite localization of the liquid to the areas to be outlined and can be carried out as a part of the diagnostic bronchoscopy.

As soon as the material has been introduced, stereograms should be made in the anteroposterior position and an exposure made in the lateral with the side of the chest to be examined toward the ray film.

The quantity to be used depends very largely upon the results desired. In an adult as much as one ounce of bismuth can be used with safety since a great part of the material is expectorated. Ordinarily 3 to 4 drams will suffice. In a normal person practically all of the powder disappears within 24 hours as a result of cough and ciliary action; rarely is there any remaining after 48 hours. The quantity of lipiodol used depends upon the age of the patient and the size of the cavities or bronchi to be mapped out and varies from 10 cubic centimeters in a patient about 10 years of age to 20 or 25 cubic centimeters in an adult. Sergent and Cottenot (5) report the use of as much as 40 cubic centimeters in

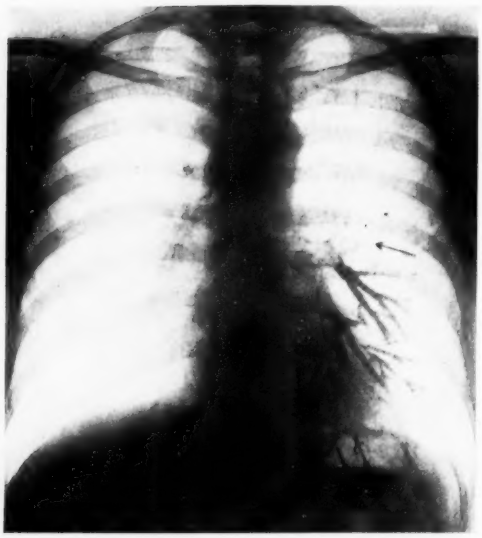

Fig. 8. Roentgenogram, made by Dr. W. F. Manges in the case of a man, age 30 years, who gave a history of hæmoptysis. Repeated physical examinations, clinical observations, and roentgen-ray studies failed to reveal any evidence of pulmonary disease. A diagnostic bronchoscopy performed 2 days after a moderate pulmonary hæmorrhage showed a small quantity of blood-tinged secretion in the left main bronchus. Pneumonography was done and bismuth subcarbonate used according to the Jackson method. Dr. W. F. Manges reported the presence of pathology in the lower portion of the upper lobe and the upper portion of the lower lobe which was more in the nature of an infiltrative process and might be tuberculous. There was rather prompt narrowing of the middle division of the upper lobe bronchus (indicated by arrow).

an adult. Several or more days are required to rid the cavities of the oil, although cases have been reported in which small portions have remained for longer period (5).

UNTOWARD RESULTS

No harmful effects have been observed in a large series of cases in which pneumonography by bismuth insufflation was done. In no case has there been any retention of the bismuth with the formation of so-called broncholiths. The use of lipiodol is not entirely without danger. Although there have been no ill results in the author's cases there has been reported one case (6) of acute iodism with œdema of the larynx. Its use is inadvisable in persons susceptible to iodine.

ANÆSTHESIA

As practiced in all endoscopic procedures at the Bronchoscopic Clinic a general anæsthetic is never used. A preliminary hypodermic injection of morphine sulphate may be given to both children and adults to obtund the cough reflex. In addition a local anæsthetic is used in adults. *This is never employed in children.*

INDICATIONS FOR PNEUMONOGRAPHY

As a diagnostic aid this method of localization presents so many possibilities that it is difficult to set forth definite indications for its use. In a general way they may, however, be stated as follows:

1. In foreign body work it has a distinct field of usefulness to localize a foreign body "around the corner," to establish the relation between a peripherally located foreign body and the nearest accessible bronchus, to determine the relative position and size of the nearest bronchus in a case of penetrating foreign body (Fig. 2), and to ascertain whether a suspected shadow is a foreign body in a bronchus or a calcareous deposit in the parenchymal tissue (Fig. 3).

2. Lung abscesses are rarely seen bronchoscopically but can be definitely outlined and localized by mapping (Fig. 4).

3. In bronchiectasis the degree and extent of the bronchial dilatation and the presence of terminal abscesses can be readily diagnosticated by the introduction of a radiopaque substance and valuable data can be obtained for the surgeon (Fig. 5). The presence and location of a bronchial stricture can be definitely ascertained as demonstrated in Luken's case (Fig. 6).

4. Helpful data can often be supplied in a case of suspected bronchopleural fistula (Fig. 7).

5. The extent of involvement of a primary malignant growth of the bronchus can often be accurately determined for the information of the surgeon as was so clearly shown in Chevalier Jackson's case (7).

6. In addition other infiltrating processes can often be demonstrated (Fig. 8).

Although there is insufficient data available to warrant any definite statement re-

garding the therapeutic value of the bronchoscopic insufflation of dry bismuth powder into a bronchus, it has been successfully used as a hæmostatic in a patient with adenocarcinoma of the bronchus who was almost completely exsanguinated from repeated pulmonary hæmorrhages (7).

CONCLUSION

1. In a large series of cases it has been conclusively demonstrated that the Jackson method of bronchoscopic insufflation of bismuth subcarbonate into the tracheobronchial tree is devoid of untoward effects. The introduction of lipiodol in selected cases seems harmless.

2. By increasing the visibility of the bronchial tree in cases of penetrating foreign bodies the roentgenologist can furnish information which will assist in determining the best method of removal.

3. In cases of lung suppuration a more accurate determination regarding the location and extent of the process is possible which will often be of great assistance in deciding the proper form of treatment.

4. Lung mapping combined with a diagnostic bronchoscopy will often lead to an early diagnosis in neoplasm of the lung.

5. Pneumonography used in conjunction with roentgenology affords the best available diagnostic aid to the thoracic surgeon.

BIBLIOGRAPHY

1. Jackson, Chevalier. Tracheobronchoscopy, Esophagoscopy and Gastroscopy. 1907, p. 69.
2. Idem. The bronchial tree, its study in the living. Am. J. Roentgenol., 1918, v, 454.
3. Beeler, R. C. Case report. J. Am. M. Ass., 1915, lxv, 14.
4. Lynah, H. L., and Stewart, W. H. Roentgenographic studies of bronchiectasis and lung abscess by the direct injection of bismuth mixture through the bronchoscope. Am. J. Roentgenol., 1921, viii, 49.
5. Sergent, E., and Cottenot, P. Intratracheal injection of lipiodol in radiography of the lungs. J. de radiol. et. d'electrol., 1923, Oct., p. 441.
6. Armand, DeLille, and Moncrieff, A. The use of lipiodol in the diagnosis of bronchiectasis. Brit. M. J., 1924, ii, 7.
7. Jackson, Chevalier. Bronchoscopy as a diagnostic aid to the thoracic surgeon. J. Am. M. Ass., 1925, lxxxiv, 97.
8. Idem. Suppurative diseases of the lung; bronchoscopic drainage as an aid to treatment by the internist. Tr. Am. Acad., Ophthalmol. & Oto-Laryngol., 1923.
9. Clerf, Louis H. Bronchoscopic lung mapping in diseases of the lungs. Surg. Clin., North America, 1924, iv, Feb.
10. Sicard and Forestier. J. méd. Franc., 1924, xiii, June.
11. Aime, Brodin, and Wolff. Bull. de l Soc. de radiol. méd. Franc., 1922, Dec. 12, 264.
12. Forestier and Leroux. Paris médical, 1922, May 12, 403.
13. LeMaitre, F. J. méd. Franc., 1924, Jan. p. 16.

AN ANALYSIS OF WOUND UNION

In 3,000 Abdominal Incisions Based on the Woman's Hospital Classification of Wounds and Wound Union

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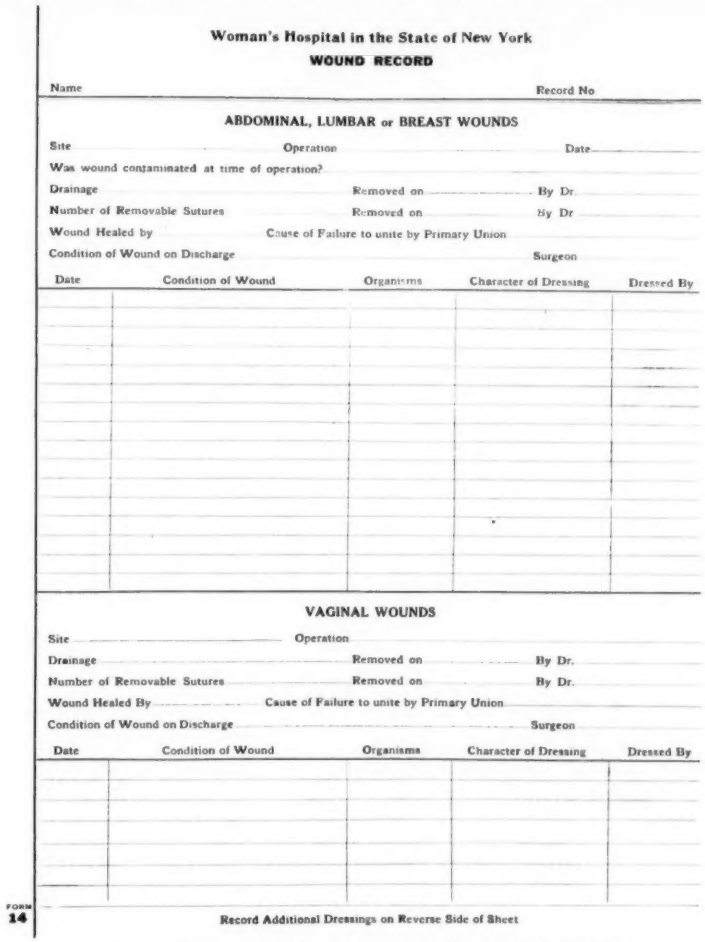
THE abdominal incision, though a very simple operation, has been ranked among the most important procedures in abdominal surgery by Sir Berkley Moynihan, who has said: "I do not think that, though much has thereon been written, it is yet adequately recognized that the steps in the making and in the repair of an abdominal wound are of the very greatest importance. I doubt whether it is any exaggeration to say that the circumstances connected with the incision are among the most important in the whole range of abdominal surgery. For, if the incision be improperly made, by the free division of muscular fibers or the willful and unnecessary severing of nerve trunks, a weakened area is left in the belly wall the result of which may be of even greater severity than those conditions which first made the operation advisable. Too great care cannot therefore be exercised in the proper choice of a method of incision and of the means of its securest closure." This authoritative opinion has encouraged the writer to submit for consideration the facts which have been established by an analysis of the wound records in 3,000 cases operated upon by the members of the attending and junior attending staffs of the Woman's Hospital.

In discussing the subject of wound union in the abdominal incision from a technical viewpoint it is important to keep clearly in mind that the methods now employed in this procedure have been practically standardized, and, furthermore, that the vast majority of surgeons are satisfied with the results which follow the employment of such methods. It is equally important, however, not to be forgetful of the fact that some form of faulty wound union occurs in a very considerable percentage of clean as well as in contaminated wounds, made and closed by standard methods, and where rigid standards are applied, constitutes the most frequent and at the same time one of the most troublesome and time consuming postoperative complications in abdominal surgery. The exact incidence of this complication has not been definitely determined because of a lack of standard classifications and adequate studies of sufficiently large series of cases.

The objects of the present study have been:

1. To establish a classification of abdominal incisions dependent upon the conditions present at the time of operation.
2. To establish a logical classification of wound union in such incisions.
3. To learn the actual incidence of faulty union in both clean and contaminated incisions.
4. To determine the maximum allowable incidence of faulty union in abdominal incisions.
5. To compare the immediate results following the different methods employed, especially in the closure of the wound.

Conditions at the Woman's Hospital have been remarkably favorable for such a study because of the fact that all members of the staff operate upon very similar classes of cases under practically identical conditions. In each case studied the pre-operative preparation, the protection of the wound at the time of operation, the materials used in the closure of the wound, and the postoperative care of the case have been the same. Furthermore, there has been in operation for the past four and a half years a definite method of recording wound union in all forms of incised wounds. It is to be noted, however, that despite the similarity of conditions under which the members of the staff work, no effort has been made to compare the results of one surgeon with those of another because of the differences in operative skill, the amount of trauma inflicted upon the tissues, and other



Woman's Hospital in the State of New York

WOUND RECORD

Name ____ Record No ____

ABDOMINAL, LUMBAR or BREAST WOUNDS

Site ____ Operation ____ Date ____

Was wound contaminated at time of operation? ____

Drainage ____ Removed on ____ By Dr. ____

Number of Removable Sutures ____ Removed on ____ By Dr ____

Wound Healed by ____ Cause of Failure to unite by Primary Union ____

Condition of Wound on Discharge ____ Surgeon ____

Date	Condition of Wound	Organisms	Character of Dressing	Dressed By

VAGINAL WOUNDS

Site ____ Operation ____

Drainage ____ Removed on ____ By Dr. ____

Number of Removable Sutures ____ Removed on ____ By Dr. ____

Wound Healed By ____ Cause of Failure to unite by Primary Union ____

Condition of Wound on Discharge ____ Surgeon ____

Date	Condition of Wound	Organisms	Character of Dressing	Dressed By

FORM 14

Record Additional Dressings on Reverse Side of Sheet

Fig. 1. Wound record sheet of Woman's Hospital of New York.

variations in technique, all of which factors obviously make such a comparison impossible. The only comparison which can be safely made is one in which the results of each individual surgeon working with but a single variable factor—the character of suture material—in two different groups of cases are compared.

METHOD OF RECORDING WOUND UNION

Early in 1919 Dr. George Gray Ward became interested in the subject of faulty wound union because of the morbidity and the costly loss of time to the convalescent patient, to the hospital, and to the prospective ward patient for which it is responsible; and instituted as a part of the hospital standardization program at the Woman's Hospital, a method of recording the facts pertaining to the making, the closure, and the union of all incised wounds of the abdominal wall, the mammary and lumbar regions, and the vagina. A wound record form (Fig. 1) was made a part of every case record so that all data concerning the wound might be recorded on one form in the record, and a simple, yet

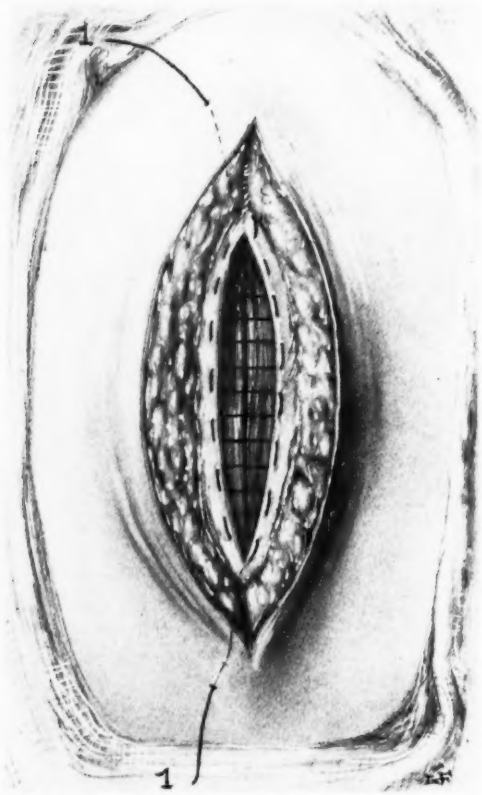


Fig. 2. The continuous mattress suture of silk placed in the sheath of the rectus muscle. The suture is placed so that it crosses the incision at intervals of 1 centimeter each.

efficient card index system was established by means of which all facts concerning wound union may be tabulated. Only through the aid of this system has it been possible for the writer to review a rather large amount of statistical material.

CLASSIFICATION OF ABDOMINAL INCISIONS

Before a study of wound union in abdominal incisions could be made it was essential that the wounds be classified according to the conditions present at the time of operation. All abdominal incisions included in this review have, therefore, been divided into two classes as follows:

Class 1. Wounds clean at the time of operation.

In Class 1 are placed wounds which have not been exposed to infectious or suspiciously infectious material during operation.

Class 2. Wounds contaminated at the time of operation.

In Class 2 are placed wounds which have been exposed to purulent material, to material from sloughing or gangrenous masses of any sort, to the contents of the urinary organs, and to the contents of the gastro-intestinal tract, excepting cases in which operations on the interval appendix or gall bladder have been performed without drainage. Wounds through which operations have been performed for acute inflammatory disease are considered contaminated, as are all wounds through which intra-abdominal or pelvic drainage has been established. On the contrary, wounds through which deliberate or accidental entrance into the vagina has been made are classified as clean wounds.

CLASSIFICATION OF WOUND UNION

The following classification of wound union, which takes into consideration not only infection as a cause of faulty wound union, but all other causes as well, has been developed and adopted as the standard classification for the Woman's Hospital:

Class A. Wounds which unite by primary union.

Any break in the union of a wound excludes it from Class A.

Any discharge of blood, serum, or fatty material which occurs after the tenth day excludes a wound from Class A.

Class B. Wounds which do not unite by Primary Union because of minor defects such as: (1) slight infection; (2) slight degree of fat necrosis; (3) small hæmatoma; (4) slight stitch hole infection which involves the line of union of the wound; (5) collection of serum discharged after the tenth day; (6) slight separation of the tissues; (7) slight degree of pressure necrosis; (8) cigarette or tube drain following the removal of which the wound heals promptly by granulation without infection; (9) cigarette or tube drain plus slight infection about the drainage tract; and (10) foreign

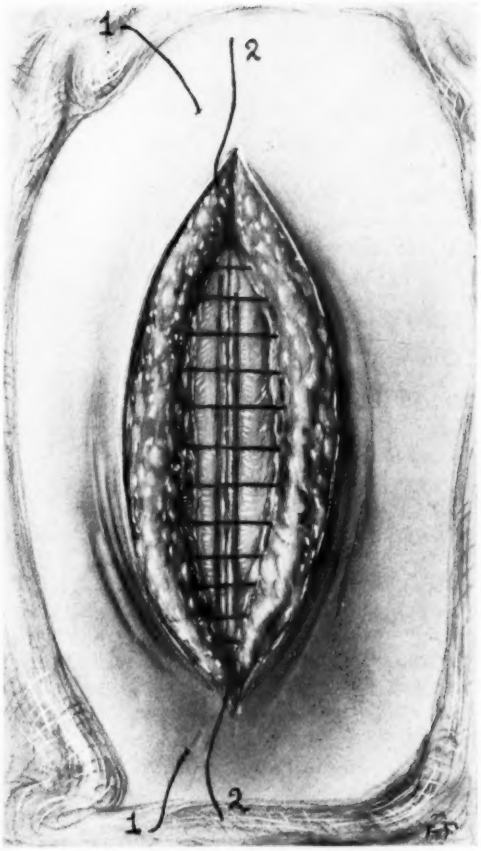


Fig. 3. The continuous mattress suture of silk placed in the deep layer of the superficial fascia of the abdominal wall.

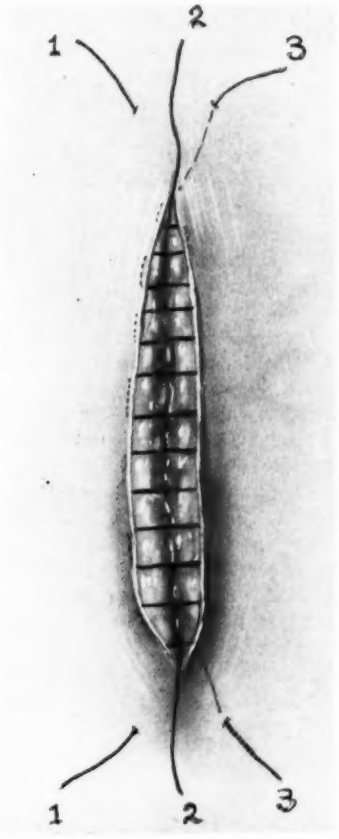


Fig. 4. The continuous subcuticular suture which closes the skin. Suture 1 is tied to Suture 3 at both ends of the incision over gauze bolsters. Suture 2 is cut 3 inches from the angles of the wound and is not tied.

body (unabsorbed suture material, etc.), following the removal of which the wound heals promptly by granulation with or without slight infection.

No case which has been detained in the hospital one or more days because of the condition of the wound is to be placed in Class B.

Class C. Wounds which do not unite by Primary Union because of major defects such as: (1) extensive infection; (2) marked degree of fat necrosis; (3) large hæmatoma; (4) extensive stitch hole infection which involves the line of union of the wound; (5) wide separation of the tissues, with or without partial evisceration, which results in prolonged healing by granulation with or without infection; (6) marked degree of pressure necrosis; (7) cigarette or tube drain, following the removal of which the drainage tract heals by prolonged granulation without infection; (8) cigarette or tube drain plus extensive infection about the drainage tract; (9) foreign body (unabsorbed suture material, etc.), causing a sinus along which there is prolonged granulation or infection; and (10) intestino-abdominal or vesico-abdominal fistula.

All cases which have been detained in the hospital one or more days because of the

condition of the wound are to be placed in Class C.

Small rubber tissue or silkworm-gut drains placed in the fat of the abdominal wall are not to be considered causes of faulty union.

MATERIAL STUDIED

The present analysis covers 3,000 abdominal incisions made and closed by 9 members of the attending and junior attending staffs of the Woman's Hospital over a period of approximately three and a half years. Of the 3,000 incisions, 2,755 have been classified as clean, while 245 incisions have been classified as contaminated at the time of operation. The procedures performed through these incisions have been largely gynecological with an occasional operation on the appendix or gall bladder, or for some type of hernia. Mammary and kidney incisions have been excluded. The vast majority of incisions have been longitudinal median ones, the remainder have been transverse suprapubic, paramedian, McBurney, or inguinal. With the exception of a very small number, the incisions have been of the intermuscular type rather than the type in which muscle fibers are separated.

PRE-OPERATIVE PREPARATION OF ABDOMEN AND PROTECTION OF WOUND AT THE TIME OF OPERATION

Approximately 12 hours before operation the abdominal skin from ensiform to pubes is washed with tincture of green soap and water which are applied with gauze. Following the removal of the soap by means of sterile water, the skin is washed with alcohol followed by ether which is allowed to evaporate before a dressing of sterile gauze is applied. Not less than 2 hours and not more than 4 hours before operation the skin is painted with 3½ per cent tincture of iodine and covered with fresh sterile gauze. A second application of 3½ per cent tincture of iodine is made on the abdominal skin a few moments before the abdomen is opened.

During the operative procedure all of the incised tissues from peritoneum to skin are protected by means of folded towels or gauze pads which are held in place by suitable clamps. The protection is not removed until the operator is prepared to close the skin incision.

METHODS OF CLOSURE OF INCISIONS

Two widely different methods of wound closure have been employed. In one the abdominal wall has been closed in layers by catgut sutures of the best quality supplied by a prominent manufacturer, reenforced by removable tension sutures of silk or silk-worm gut; in the other the closure has been accomplished by means of removable silk sutures in all layers excepting the peritoneum. The former method is one with which all surgeons are familiar, while the latter method is unique and, therefore, requires a somewhat detailed description.

CLOSURE OF THE ABDOMINAL INCISION BY REMOVABLE SUTURES OF SILK

A number of years ago Dr. C. G. Child, of New York, conceived the idea that catgut, which must be converted into a soluble gelatin before absorption by the body tissues is possible, constituted an important predisposing cause of infection in the incised abdominal wound. He reasoned that this gelatinous material in the presence of body temperature, body tissues and fluids formed a favorable culture medium for the growth of pyogenic micro-organisms which might be introduced at the time of operation, and that the absorption of catgut placed an unnecessary burden upon the tissues of the belly wall, especially on the areolar, fat filled and relatively avascular layer, which lies between the anterior sheath of the rectus muscle and the skin. He, furthermore, argued that catgut, because of its unreliability in sterility and tensile strength and the wide variations in the time necessary for its absorption in different individuals, was not a dependable suture material to employ in a structure such as the sheath of the rectus muscle, upon which the future integrity of the belly wall largely depends. Child, therefore, abandoned all absorbable suture material in the closure of the abdominal incision in all layers excepting the peritoneum, and attempted to close the wound by means of a continuous mattress

suture of silkworm-gut, which was to have been removed on the twelfth or fourteenth postoperative day. This method proved a failure because of the difficulty of removing without breaking the suture. Silver wire in the form of a continuous mattress suture was next tried and, though not practical, because of considerable difficulty in placement and removal, was responsible for very excellent results. The incidence of infection in wounds closed by this method was decidedly lower than in gut closed wounds. In 1915 there was placed upon the market, by a prominent manufacturer of suture material, a specially treated twisted silk tension suture of great tensile strength and pliability. This material was substituted for silver wire in the closure of incisions and has given practically ideal results. This last method has been used in the closure of 1,110 clean and 87 contaminated incisions in the series under consideration. In detail the method is as follows:

Placing the sutures. The peritoneum, transversalis fascia, and posterior sheath of the rectus muscle are closed by a continuous suture of plain catgut.

The rectus muscle is not sutured.

The anterior sheath of the rectus muscle is closed by a continuous mattress suture of the prepared silk, both ends of which are carried through the fatty layer and skin to the surface on one side of the incision at the angles of the wound (suture 1, Fig. 2).

The deep layer of the superficial fascia of the abdominal wall is closed by a continuous mattress suture of prepared silk, the ends of which are passed through the fatty tissue and emerge at the angles of the wound (suture 2, Fig. 3).

The skin is closed by a subcuticular continuous suture of prepared silk, the ends of which are passed through the skin to the surface on the side of the wound opposite that upon which the deepest suture emerged (suture 3, Fig. 4).

When the sutures are being tightened, it is important not to pull them backward and forward after they have been placed, but to allow them to remain stationary as there is a certain cohesion between tissues and suture material which assures an ideal approximation until union is complete.

Suture No. 1 is tied by a bow-knot to suture No. 3 over a gauze bolster at the lower angle of the wound. The other ends of the same sutures are tied together in a similar manner at the upper angle of the incision. The ends of suture No. 2 should be at least 3 inches each in length and should not be tied.

Removal of sutures. On the tenth postoperative day the bow-knot at the lower angle of the incision is untied and the bolster removed. A small amount of tincture of iodine is allowed to run into the suture tracts, the sutures are iodinized near the skin and then cut beneath the surface of the skin. At this time the upper ends of the sutures are not disturbed. No attempt to remove any of them at this time is made. On the twelfth day the upper bow-knot is untied and a gentle attempt made to withdraw all three sutures—the skin suture (suture No. 3) first, the suture in the deep layer of the superficial fascia (suture No. 2) next, and finally the suture in the anterior sheath of the rectus muscle (suture No. 1).

If the removal of any of the sutures is found to be difficult, a small artery clamp is placed on the end of the suture to prevent retraction beneath the skin and wrapped in the dressing until a second attempt is made the following day. The second or third attempt results in easy removal, if the sutures have been properly placed at the time of closure.

The advantages of this method of wound closure over the usual catgut method are:

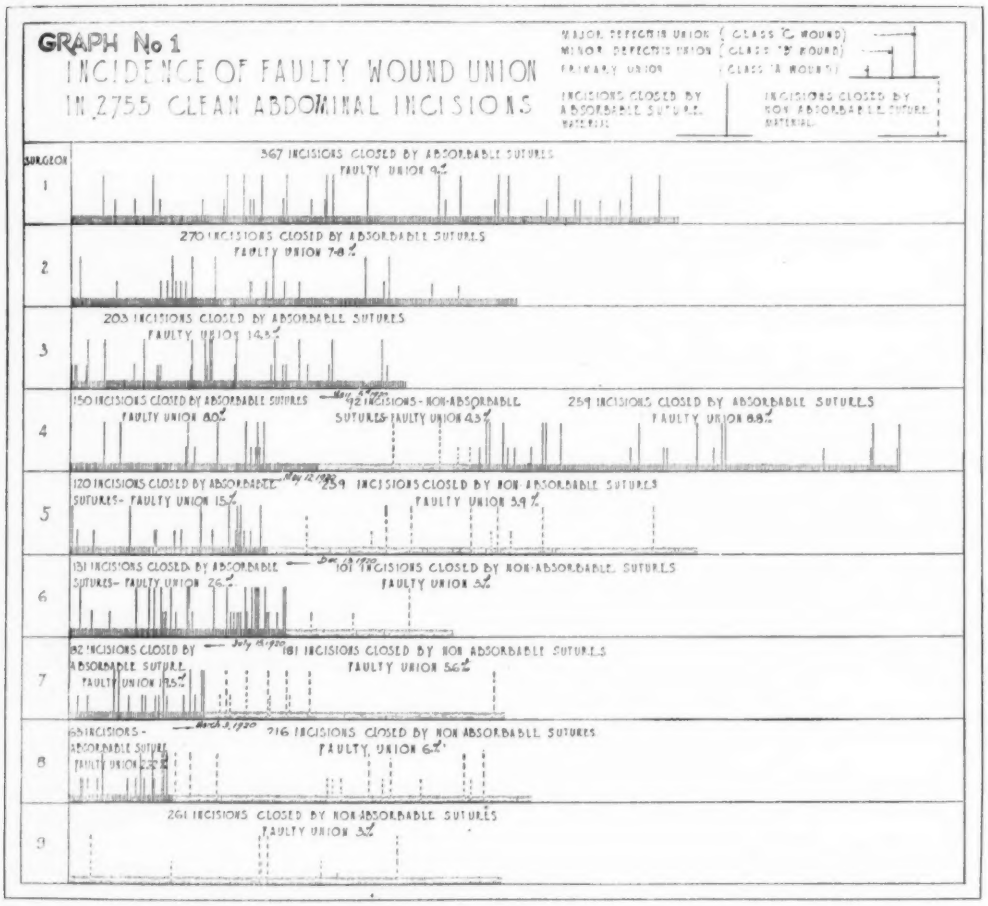
1. A dependable suture material of great tensile strength is employed. The tensile strength of catgut is always questionable: after the 10th postoperative day it is negligible.

2. The suture material is thoroughly sterilizable without a reduction in its tensile strength. The sterility of catgut is always questionable.

3. The tissues, especially the fatty tissues, are not required to absorb a foreign body, such as catgut.

4. Apposition is ideal without strangulation of the tissues until union is complete.

There is but a single objection to the method, and that not a serious one, namely, removal is difficult if the suture has not been properly placed or if a premature attempt at

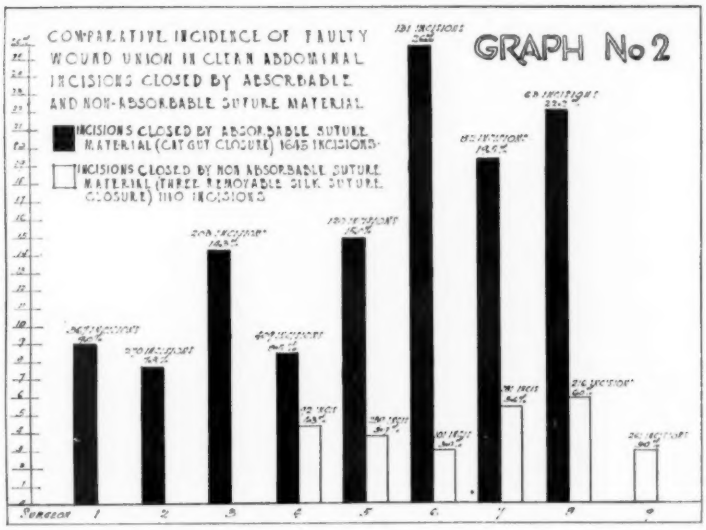

GRAPH No 1
INCIDENCE OF FAULTY WOUND UNION
IN 2755 CLEAN ABDOMINAL INCISIONS
MAJOR DEFECTIVE UNION (CLASS 'C' WOUND)
MINOR DEFECTIVE UNION (CLASS 'B' WOUND)
PRIMARY UNION (CLASS 'A' WOUND)
INCISIONS CLOSED BY ABSORBABLE SUTURE MATERIAL
INCISIONS CLOSED BY NON ABSORBABLE SUTURE MATERIAL
SURGEON
1
367 INCISIONS CLOSED BY ABSORBABLE SUTURES
FAULTY UNION 9%
2
270 INCISIONS CLOSED BY ABSORBABLE SUTURES
FAULTY UNION 7.8%
3
203 INCISIONS CLOSED BY ABSORBABLE SUTURES
FAULTY UNION 14.8%
4
150 INCISIONS CLOSED BY ABSORBABLE SUTURES
FAULTY UNION 80%
42 INCISIONS - NON-ABSORBABLE SUTURES FAULTY UNION 43%
259 INCISIONS CLOSED BY ABSORBABLE SUTURES
FAULTY UNION 88%
5
120 INCISIONS CLOSED BY ABSORBABLE SUTURES - FAULTY UNION 15%
259 INCISIONS CLOSED BY NON ABSORBABLE SUTURES
FAULTY UNION 39%
6
131 INCISIONS CLOSED BY ABSORBABLE SUTURES - FAULTY UNION 26%
101 INCISIONS CLOSED BY NON-ABSORBABLE SUTURES
FAULTY UNION 8%
7
82 INCISIONS CLOSED BY ABSORBABLE SUTURE
FAULTY UNION 17.5%
181 INCISIONS CLOSED BY NON ABSORBABLE SUTURES
FAULTY UNION 56%
8
65 INCISIONS - ABSORBABLE SUTURE
FAULTY UNION 23%
216 INCISIONS CLOSED BY NON ABSORBABLE SUTURES
FAULTY UNION 6%
9
264 INCISIONS CLOSED BY NON ABSORBABLE SUTURES
FAULTY UNION 3%

removal is made. If perchance a part of a suture should be left permanently in the tissues through breakage at the time of removal, no harm has been done. In this connection it is important to bear in mind the fact that surgeons of wide experience bury silk sutures in the sheath of the rectus with no intention of removing them. In no case in the series studied has it been necessary to reopen the wound for the removal of a suture broken in removal.

Of 2,755 incisions classified as clean, 1,645 have been closed by the conventional catgut method, while, 1,110; have been closed by the removable silk suture method described above. Of 245 incisions classified as contaminated at the time of operation 158 were closed by catgut and 87 closed by removable silk sutures. The results are shown in the following graphs.

ANALYSIS OF GRAPHS

Graph 1 shows the chronological incidence of faulty wound union in 2,755 clean abdominal incisions. It brings out the fact that Surgeon 1 has closed 367 incisions by the conventional catgut method with a faulty union of 9 per cent. Surgeon 2, who has used a similar method in 270 cases has met with an incidence of faulty union of 7.8 per cent, while, in the work of Surgeon 3, who has also used a


COMPARATIVE INCIDENCE OF FAULTY WOUND UNION IN CLEAN ABDOMINAL INCISIONS CLOSED BY ABSORBABLE AND NON-ABSORBABLE SUTURE MATERIAL
GRAPH No 2
INCISIONS CLOSED BY ABSORBABLE SUTURE MATERIAL (CATGUT CLOSURE) 1645 INCISIONS
INCISIONS CLOSED BY NON ABSORBABLE SUTURE MATERIAL (THREE REMOVABLE SILK SUTURE CLOSURE) 1110 INCISIONS
Surgeon 1 2 3 4 5 6 7 8 9

catgut closure in 220 incisions, there has been an incidence of faulty union of 14.3 per cent. The part of the graph which deals with the work of the next 5 surgeons, Surgeons 4, 5, 6, 7, and 8, is of special interest in that it shows a decided reduction in the incidence of faulty union upon the abandonment of catgut and the adoption of the removable silk suture method of closure. In the case of Surgeon 4 there has been a reduction of faulty union of approximately 100 per cent, while it has been greater in the work of Surgeons 5, 6, 7, and 8. It will be noted that the conversion from one type of closure to the other has occurred at a different time in each instance. Surgeon 9, who has employed only the removable silk suture method of closure in 261 incisions, has met with an incidence of faulty union of 3.0 per cent. This graph brings out very clearly one very important point, namely, *that with all other factors remaining constant*, the adoption of the removable silk method of closure has, in the work of all surgeons who have used both methods, invariably resulted in a very decided reduction in the incidence of faulty union in the abdominal wound.

Graph 2 shows clearly the relative incidence of faulty union in clean incisions closed by absorbable and non-absorbable suture material. Special attention is called to the fact that the incidence of faulty union in incisions closed by the removable silk suture method has been in every instance lower than the lowest incidence in catgut closures.

Graph 3 shows the relative incidence of the *causes* of faulty union in 2,755 clean abdominal incisions. In practically every instance the incidence of defective union has been lower in the wounds closed by non-absorbable suture material. The one exception is found under the heading "Wide Separation of Tissues" in which case the figures are based on three accidents of this sort in the work of Surgeon 4 and one in the work of Surgeon 9. The graph shows clearly that the total average incidence of faulty union in clean abdominal incisions from all causes has been 4.3 per cent in wounds closed by non-absorbable suture material, while in wounds closed by absorbable sutures the total average incidence of faulty union has been 12.1 per cent.

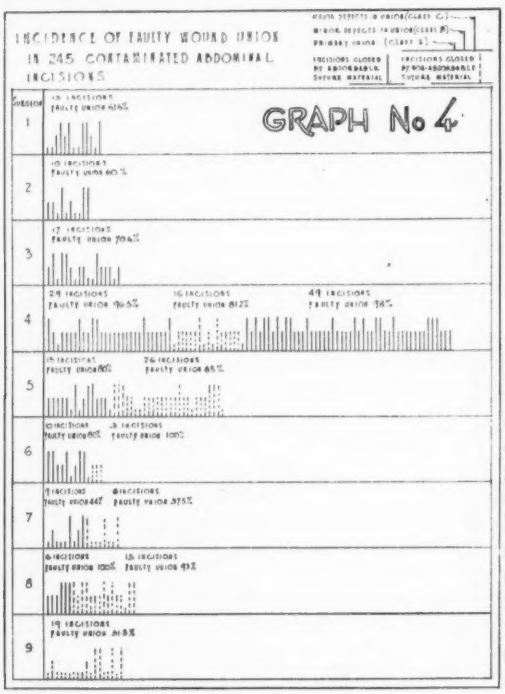
Graph 4 shows the chronological incidence of faulty wound union in 245 contaminated abdominal incisions. Attention is called to the fact that the number of contaminated cases operated upon by each surgeon is small excepting in the case of Surgeon 4. The graph, therefore, is of somewhat less value than if there had been larger numbers of cases from

GRAPH No 3 — RELATIVE INCIDENCE OF THE CAUSES OF FAULTY WOUND UNION IN 2755 CLEAN ABDOMINAL INCISIONS EXPRESSED IN PERCENTAGES

SURGEON	1	2	3	4	5	6	7	8	9	AVERAGE INCIDENCE
EXTENSIVE INFECTION (CLASS C)	4.1	2.2	4.9	11 / 4.4	2.7 / 4.2	10 / 9.9	2.8 / 6.1	3.2 / 9.5	1.1	2.1 / 4.7
SLIGHT INFECTION (CLASS B)	2.5	4.1	6.9	2.1 / 3.3	1.2 / 10.0	2.0 / 9.1	2.6 / 12.2	2.3 / 11.1	1.5	1.9 / 8.3
LARGE HEMATOMA (CLASS C)	0.3	0.4	0.3			0.8	1.2	0.5		0.1 / 0.4
SMALL HEMATOMA (CLASS B)	0.5	0.7	1.0	0.2		0.8		1.6		0.5
EXTENSIVE FAT NECROSIS (CLASS C)						0.8				0.1 / 0.6
SLIGHT FAT NECROSIS (CLASS B)	0.8	0.6	0.6			0.8				0.6
WIDE SEPARATION OF TISSUES (CLASS C)				1.1 / 0.2					0.4	0.2 / 0.06
SLIGHT SEPARATION OF TISSUES (CLASS B)			0.5	0.2						0.1
COLLECTION OF SERUM (CLASS B)	0.5			0.2						0.2
FOREIGN BODY (CLASS B)	0.3									0.1
FECAL FISTULA (CLASS C)					0.8	0.8				0.1
TOTAL INDIVIDUAL INCIDENCE OF FAULTY WOUND UNION	7.0	7.8	14.3	4.3 / 8.5	3.9 / 15.0	3.0 / 20.9	5.6 / 17.8	6.0 / 22.2	3.0	TOTAL AVERAGE INCIDENCE OF FAULTY UNION 4.3 / 12.1

LIGHT FACED FIGURES INDICATE THE INCIDENCE OF FAULTY WOUND UNION IN CLEAN INCISIONS CLOSED BY ABSORBABLE SUTURE MATERIAL — HEAVY FACED FIGURES INDICATE THE INCIDENCE OF FAULTY WOUND UNION IN CLEAN INCISIONS CLOSED BY NON-ABSORBABLE SUTURE MATERIAL

which to draw conclusions. Here again is shown the reduction in faulty union which accompanies the conversion from the use of absorbable to non-absorbable suture material in the closure of abdominal incisions, excepting in the work of Surgeons 5 and 6, where the incidence of faulty union has been slightly higher in the case of wounds closed by non-absorbable material. It is doubly difficult to draw conclusions when studying contaminated cases because of the wide variations in the nature of the contamination.



Graph 5 shows the relative incidence of faulty union in contaminated wounds closed by absorbable and non-absorbable suture material. Here it is also important to remember that the graph is based upon a small number of cases.

Graph 6 shows the relative incidence of the various *causes* of faulty union in 245 contaminated incisions. It is to be remembered that this graph also deals with small numbers of cases and, therefore, is not of great value excepting for the averages which it shows. It is to be noticed that the average incidence of the several causes of faulty union is always lower in incisions closed by non-absorbable suture material than in those closed by catgut excepting under the heading "Major Infections" where the incidence is slightly higher than in the gut closed wound. The graph finally shows that the total average incidence of faulty wound union in contaminated in-

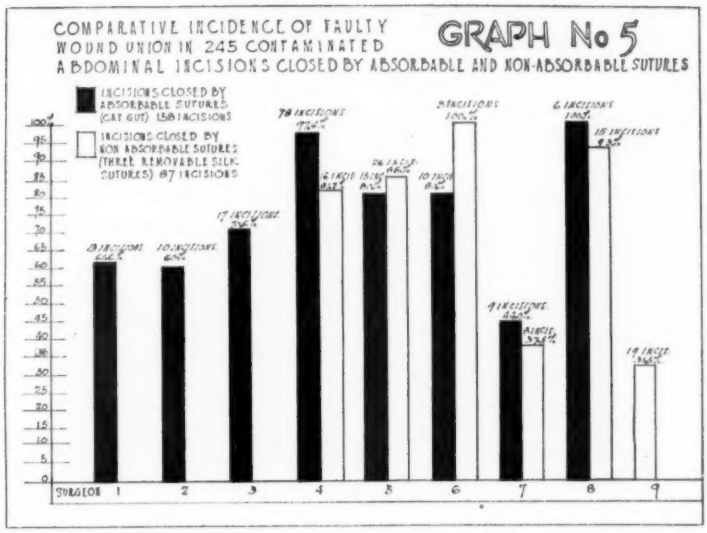

COMPARATIVE INCIDENCE OF FAULTY WOUND UNION IN 245 CONTAMINATED ABDOMINAL INCISIONS CLOSED BY ABSORBABLE AND NON-ABSORBABLE SUTURES
GRAPH No 5
INCISIONS CLOSED BY ABSORBABLE SUTURES (CAT GUT) 158 INCISIONS
INCISIONS CLOSED BY NON ABSORBABLE SUTURES (THREE REMOVABLE SILK SUTURES) 87 INCISIONS
SURGEON 1 2 3 4 5 6 7 8 9

TABLE A.—INCIDENCE OF INFECTION IN 2,755 CLEAN ABDOMINAL INCISIONS

	Extensive infections (CLASS C) Per cent	Slight infections (CLASS B) Per cent
1,645 incisions closed by absorbable sutures (catgut closure)	4.7	5.3
1,110 incisions closed by non-absorbable sutures (removable silk suture closure)	2.1	1.9

TABLE B.—INCIDENCE OF INFECTION IN 245 CONTAMINATED ABDOMINAL INCISIONS

	Extensive infections (CLASS C) Per cent	Slight infections (CLASS B) Per cent	Drainage + extensive infection (CLASS C) Per cent	Drainage + slight infection (CLASS B) Per cent
158 incisions closed by absorbable sutures (catgut closure)	8.9	4.4	19.6	8.2
87 incisions closed by non-absorbable sutures (removable silk suture closure)	9.1	3.4	17.2	8.0

cisions from all causes including drainage, has been 70 per cent in wounds closed by non-absorbable suture material against 83.5 per cent in wounds closed by catgut.

A perusal of Graphs 3 and 6 shows that, though there are other important causes of faulty wound union, *infection is the principal cause.* Since this is true, and since surgeons who consider infection only when thinking of faulty wound union may care to compare their results with those of the Staff of the Woman's Hospital, tables which show the incidence of infection only have been prepared (Tables A and B).

A final examination of the six graphs reveals facts which substantiate Child's theory that absorbable suture material, such as catgut, used in the closure of the abdominal incision, constitutes the important and avoidable predisposing cause of infection in the tissues about the incision, especially in the more or less avascular fatty layer, which possesses lower powers of resistance to infection than the fascia and skin which lie on either side of it. Furthermore, the figures show that in the hands of the same surgeon, *with all factors excepting the character of suture material remaining constant,* the conventional catgut closure, which has been so generally adopted as the method of choice,

RELATIVE INCIDENCE OF THE CAUSES OF FAULTY WOUND UNION IN 245 CONTAMINATED ABDOMINAL INCISIONS

GRAPH No 6 EXPRESSED IN PERCENTAGES

SURGEON	1	2	3	4	5	6	7	8	9	AVERAGE INCIDENCE
				0	0	0	25.	15.	21.	9.4
EXTENSIVE INFECTION (CLASS C)	7.7	20.	17.6	1.3	1.8	5.0	0	0		8.9
				0		33.3		0	10.5	3.4
SLIGHT INFECTION (CLASS B)	16.6		11.8	1.3		1.0		16.7		1.4
DRAINAGE PLUS EXTENSIVE INFECTION (CLASS C)	30.8	10.	5.9	12.5	27.		12.5	33.		17.2
				24.3	1.8		2.2	38.2		17.6
DRAINAGE PLUS SLIGHT INFECTION (CLASS B)	7.7	10.		12.5	0.			20.		8.0
				11.5	7.			16.7		8.2
DRAINAGE (CLASS C)				0		33.3		7.		2.3
				2.6				16.7		1.9
DRAINAGE (CLASS B)		20.	35.3	56.2	50.	33.3		20.		30.
				55.1	47.0	2.0	22.0	16.7		37.9
LARGE HEMATOMA (CLASS C)				0						
				1.3						.6
TOTAL INDIVIDUAL INCIDENCE OF FAULTY UNION	61.6	60.	17.6	81.2	85.	100.	37.5	93.	31.5	TOTAL INCIDENCE OF FAULTY UNION 16.7
				17.4	8.0	8.0	44.0	100	0	83.5

LIGHT FACED LETTERS INDICATE THE INCIDENCE OF FAULTY WOUND UNION IN 164 CONTAMINATED ABDOMINAL INCISIONS CLOSED BY ABSORBABLE SUTURES

HEAVY FACED LETTERS INDICATE THE INCIDENCE OF FAULTY WOUND UNION IN 87 CONTAMINATED ABDOMINAL INCISIONS CLOSED BY NON-ABSORBABLE SUTURES

gives results inferior to those which follow the closure of the wound by removable non-absorbable suture material such as silk.

The site of the abdominal incision is believed by some to be a factor in wound infection. Some surgeons are firmly of the opinion that the longitudinal median type of incision is less likely to become infected than the transverse suprapubic type, while others believe the contrary. In this study it has been found impossible to make a definite statement on this point because of the fact that no one surgeon has used both types of incision a sufficient number of times to warrant a conclusion. It is interesting to note, however, that Surgeon 3, who has used the catgut closure only, has met with an incidence of faulty union of 14.8 per cent in a series of 108 clean transverse suprapubic incisions and of 12.6 per cent in a series of 95 clean longitudinal incisions, while Surgeon 9, who has employed the removable silk suture method of closure only, has met with an incidence of faulty union of 2.4 per cent in a series of 165 clean transverse incisions and of 4.2 per cent in a series of 96 longitudinal incisions. It will be noted that the incidence of faulty union of 2.4 per cent in 165 clean transverse suprapubic incisions represents the lowest incidence of faulty union in the entire series studied. It is obvious, therefore, that the incidence of faulty wound union can be kept as low, if not lower, in the transverse type of incision than in the longitudinal incision, despite the belief that the transverse type of wound is the more likely to become infected.

From an economic viewpoint faulty union in the abdominal incision is a costly and time-consuming complication to both patient and hospital. In the series of 3,000 cases under consideration there has been a total loss of 3,086 hospital days due to defective wound union. In the series of 2,755 incisions, clean at the time of operation, 248 failed to unite by primary union with a loss of 1,587 hospital days, while in the series of 245 contaminated incisions 193 failed to unite by primary union with a loss of 1,499 hospital days. It is difficult to calculate with any degree of exactness the loss of hospital days which might be considered justifiable in this or any other series of cases. It is obvious, however, that no other postoperative complication with which the abdominal surgeon meets is responsible for a loss of time comparable to that caused by faulty union of the abdominal incision made and closed by conventional methods.

It is to be regretted that time has not permitted a study of end-results in the entire

series of cases, especially in regard to the incidence of postoperative herniæ. That study will be made in the future.

A review of the material studied leads to the following conclusions:

1. If correct standards are rigidly applied in the recording of wound union, faulty union in abdominal incisions, made and closed by standard methods, constitutes the commonest postoperative complication in abdominal surgery.

2. The most important predisposing causes of faulty wound union in the order of importance are absorbable suture material (catgut), trauma and poor technique.

3. The principal exciting cause of faulty wound union is infection.

4. In the series of cases studied, the average incidence of faulty wound union from all causes in clean abdominal incisions closed by absorbable suture material has been 12.1 per cent, while in clean incisions closed by non-absorbable suture material it has been 4.3 per cent.

5. The average incidence of *infection* in clean abdominal incisions closed by absorbable suture material has been 10 per cent, while in clean incisions closed by non-absorbable suture material it has been 4.0 per cent.

6. The average incidence of faulty wound union from all causes in contaminated abdominal incisions closed by absorbable suture material has been 83.5 per cent, while in contaminated incisions closed by non-absorbable suture material it has been 70.0 per cent.

7. The average incidence of *infection* in contaminated abdominal incisions closed by absorbable suture material has been 41.1 per cent, while in contaminated incisions closed by non-absorbable suture material it has been 37.7 per cent.

8. With the methods available at the present time the incidence of faulty wound union from all causes should not exceed 5 per cent in clean incisions and 70 per cent (including drainage as a cause of faulty wound union), in contaminated incisions.

9. A comprehensive classification of wound union will take into consideration not only infection as a cause of faulty wound union but all other causes as well.

REFERENCES

1. Moynihan, Sir Berkley. Abdominal Operations. 1916, i, 105.
2. Child, C. G. Closure of the abdominal incision. J. Am. M. Ass., 1907, xlviii, 221.

DOES BONE FORM FROM OSTEOBLASTS OR FROM A METAPLASIA OF THE SURROUNDING CONNECTIVE TISSUE?

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OPINIONS vary as to the rôle played by the different tissues of bone in its regeneration. One investigator may regard the periosteum, another the endosteum, and another the cells of the bone itself, as the important factor in the union of fractures, in the correction of defects, and in the obtaining of satisfactory results in transplanting bone. It should be mentioned that there are investigators who regard the periosteum, endosteum, or bony cells themselves as capable of producing bone and that the other tissues of the bone have no function whatsoever. However, there are some men who believe that the formation of bone after trauma, etc., and in transplants, is dependent largely and sometimes entirely on a metaplasia of the surrounding connective tissue.

In our study we have endeavored to determine two points:

1. What rôle the different elements of bone play in bone regeneration.
2. What the possibilities are for bone regeneration from metaplasia of the connective tissue.

1. The Rôle of the Different Bone Elements in Bone Regeneration

In contradistinction to the "physiological regeneration," there is, with the regeneration which starts as a result of tissue stimulation, an "accidental or pathological regeneration," which is the change in the tissue caused by external damage of some kind (infection or injury). The difference between the two forms of regeneration is basic and depends upon these factors: In physiological regeneration the used and lost tissue substance is constantly replaced in a typical way; in the pathological regeneration a complete anatomical replacement is never attained even if an attempt is made to replace functionally the lost or damaged tissue. The most complete regeneration is found in the replacement of injured parts of the connective tissue of blood vessels. The specific organ or tissue to which bone belongs as a whole is of such a nature as to make the normal regeneration of bone impossible.

These basic principles, which are true for all pathological regeneration, also apply in all healing processes which are the result of injury or trauma to bone. At best the end-result may show a very nearly normal bone in form and structure (complete regeneration), or it may show a bone which is more or less abnormal in form (incomplete regeneration), but which gives good function. The amount of regeneration attained depends directly upon the extent to which the blood-vessel connective-tissue apparatus of the organ or tissue is disturbed through the damaging influence of the processes following injury or infection, so that it is important to remember how essential it is to preserve the blood supply and to avoid changes in the blood-vessel apparatus of the bone in question which might result from a manipulation to obtain a complete anatomical and functional result.

Lexer has repeatedly emphasized the great importance of this knowledge. According to Lexer, as a result of injury, the blood-vessel system of the bone involved reacts by filling the blood vessels and new blood vessels are formed. These processes follow one another with the constancy of a law of nature. As a result of hyperæmia all the functions of the involved bone are increased, and, with this, the regeneration changes begin. Through the hyperæmia the organism prepares for regeneration; the tissues at the site of, and surrounding, the injury securing nutrition to the part and the replacement of material and removal of waste products. In addition through the disturbance of the processes inaugurated by the hyperæmia, the hyperæmia is further maintained through the products of destruction and the blood. The causes of regeneration in

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chronological order are: trauma, hyperæmia, and products of tissue destruction. Their results are: hyperplasia, proliferation, and hypertrophy of the specific and non-specific tissue elements, which, under normal conditions, develop into fibrous scar tissue or a pseudo-arthrosis.

To determine the rôle the different bone tissues play in bone regeneration, a series of experiments were performed with each tissue of the bone, that is periosteum, endosteum, and the compact bone. Always just the one tissue was tested, the other two were destroyed. At the same time in each series, the blood supply to the tissue to be tested was kept intact, while that going to the other two tissues was damaged. The influence of the *age* and *function* was also considered.

With reference to the series of experiments to test the ability of the periosteum to regenerate, a few fundamental facts must be noted. The periosteum is built up of two layers: the outer layer, the adventitia, is made up of connective tissue rich in blood vessels and serves as a connection between the surrounding tissue, provides for the most part the nourishment of the bone, and serves as a delimiting membrane; the inner layer, the fibro-elastica, or cambium layer, is poor in blood vessels, consists of elastic fibers running in the long direction of the bone and round, spindle-shaped connective-tissue cells, also connective-tissue fibers and presents on the side toward the bone a layer of cortical cells with round, dark colored nuclei (osteoblasts). The periosteum is bound to the bone by the interlacing of blood vessels in and out of the bone into the periosteum, through bundles of connective tissue (Charpey's fibers) and by means of elastic fibers. This union is loose in growing and young adult animals, but it is quite firm in full grown and especially in old animals. The fullness of the blood vessels in the bones decreases with age. As the real specific layer capable of regenerating bone is the cambium layer and as it receives its blood supply from the adventitia (the blood vessels coming through the compact bone from the marrow canal are of little importance), it is clear, that for bone regeneration, both layers, and in proper relationship, are necessary. It is clear too that the adventitia should not be separated from the surrounding soft parts, because from the soft parts the blood vessels penetrate into the adventitia. On the other hand, it is not necessary for periosteal regeneration and bone production that there be union between the cambium layer and the compact bone. In doing the experiments and in estimating the results, it is important to keep the cambium layer, adventitia and surrounding soft parts of the bone (fascia, muscles, and connective tissue) in their natural relationship. This can be done only if at operation the compact bone (ulna or radius) is exposed by an incision made by a sharp knife, and the work is done through this incision. The periosteal tube, together with its surrounding tissues, is separated by sharp dissection from the compact bone (Lexer).

At operation we worked from the radial side of the forearm toward the radius, or, in other cases, from the ulnar side toward the ulna, taking the greatest care not to disturb the soft parts. After separating the periosteal tube together with the soft parts for 1.5 to 2 centimeters, the compact bone and marrow were removed by sawing the freed bone through at both ends, curetting the marrow canal of the bone remaining at each end with a sharp curette, or plugging each end (in order to exclude the myelogeno-endosteal bone regeneration). Following this, the periosteal tube with its nutrient vessels undisturbed and the soft parts were carefully sutured. In other experiments, under the same conditions, only one-half of the periosteal tube was left and the other half removed. In these cases the ends of the bones were not united by means of a periosteal tube but by half a periosteal tube which was not sutured. The marrow canals were curetted, and the soft parts sutured. In other experiments the radius or the ulna with its surrounding periosteum would be freed for about 2 centimeters from its surrounding soft parts. From this piece of periosteum and bone, completely freed from its surroundings, a piece of bone 1.5 centimeters long, including the marrow canal, was sawed out subperiosteally and the marrow canals of the ends remaining filled with an autogenous piece of compact bone (without

periosteum and no endosteum). This periosteal tube, which had been completely separated from its surrounding soft parts was sutured and the soft parts closed. In these experiments the bone ends were united by means of a periosteal tube which covered the bone ends, but the tube had been separated from the soft parts and, therefore, was separated from its blood supply.

In our experiments on old animals we were never able to obtain bone regeneration from the periosteal tube. Lexer has pointed out that on account of the union between the cambium layer and the cortical layer in adult bone, the separation of the periosteum from the bone is difficult and, under normal conditions, is extremely unsuccessful. According to Lexer, it is for this reason that bone regeneration is unsuccessful in these experiments. Axhausen believes that the periosteum of full grown animals cannot produce bone, because it has exhausted the power to do so. By means of infection or trauma, according to Axhausen, it can be stimulated again; in these cases the stimulus for growth comes from necrotic bone next the periosteum. Bier and his school consider that in such cases there is a hormone coming from the living bone which influences the periosteum to regenerate bone. According to Lexer there is a growth stimulus which comes from the necrotic bone and works upon the osteoblasts. However, the main cause for bone regeneration is to be sought in cases in which the periosteum and bone are united, for between the periosteum and the compact bone, where the cambium cells are retained, bone regeneration takes place. From these facts it develops that under the usual experimental conditions *the periosteum of old animals does not form bone.* For the development of its bone building power, the blood supply which comes from surrounding tissue must not be destroyed so that the hyperæmia from the fracture may reach the cambium layer. Following our line of reasoning—that by retaining the natural union between the periosteum and compact bone, even in old animals, where the retained cambium cells produce bone—we exposed the compact bone in old animals by means of an incision in the usual manner, loosened the periosteum a little from the compact bone, and through this opening of the periosteum removed the cortex with a Luer rongeur so that only a small part of its outermost layer was in contact and remained with the periosteum. The marrow canals were curetted as usual. Viewed from the incision one could see the periosteal tube with small pieces of cortex clinging to the periosteum which was united with the surrounding soft parts. At these places where the bone clings to the periosteum the cambium layer was retained. The periosteal tube and soft parts were sutured as usual.

In other cases in old animals we studied the periosteal regeneration processes after the compact bone and endosteum had been removed. Preceding operation the periosteum was stimulated through trauma. Lexer has pointed out that in old animals such a traumatically stimulated periosteum with its layer of osteoid and cambium cells is easily separated from the cortex. Following Lexer's experiments we produced subcutaneous fracture of both forearm bones in old animals, and put the limb at rest in a plaster-of-Paris splint. After 8 days, the splint was removed and from the middle of the radius a cylinder of bone marrow and endosteum was resected in the usual way, the cylinder containing the site of the fracture. We show, as Lexer found in his experiments, that in the region of the fracture the periosteal tube which just above and below was thickened by callous formation was easily separated in the region of this callous formation from the cortex. As a result of the extraordinary fracture hyperæmia in these experiments, the bleeding was quite marked at operation, the opposite of what had occurred in previous experiments. Also, in this series of experiments the marrow canal at both ends was curetted, and the periosteal tube and the surrounding soft parts sutured. A plaster-of-Paris splint was worn for 4 weeks.

At the same time certain preliminary remarks with reference to the series of experiments determining the bone building power of the endosteum must be made. A separate discussion of endosteum and marrow is not necessary, as first, both are in intimate contact so that it is impossible to separate them

without disturbing them; and, second, the endosteum is nothing more than a very thinly developed fibrous membrane of the marrow which is attached to the compact bone and completes the lining of the marrow canal. The endosteum is furthermore built up of connective tissue, blood vessels, and cells. The endosteum consists of one layer of flat or cubical cells (osteoblasts) and fine, connective-tissue bundles. Connective-tissue fibers traverse the whole marrow canal; elastic fibers are absent. For our investigation the marrow cells are of no interest, but the osteoblasts, osteoclasts, connective-tissue and fat cells are of importance. In our experiments we could convince ourselves that in the diaphysis of young animals there was red, myeloid marrow, and in the diaphysis of old animals yellow, fatty marrow. Quantitatively the osteoblastic tissue in the marrow endosteum was more abundant than that in the periosteum. The blood vessel supply of the marrow endosteum according to Lexer's investigations in young animals comes from four sources; first, through diaphyseal circulation of the nutrient artery; second, through blood vessels of the metaphysis; third, through blood vessels of the epiphysis; fourth, through anastomoses which come from the periosteal vessels and pierce the cortex. In young subjects there are, especially at the period of greatest growth, profuse anastomoses between the blood vessels and marked filling of the blood vessels. After this growth has completed itself, this hyperæmia subsides, so that the endosteum of the marrow is cared for only by the delicate nutrient artery and isolated anastomoses between metaphyseal and epiphyseal blood vessels.

It is of the greatest importance to injure the endosteum of the marrow as little as possible. At first we attempted by means of a small rongeur to remove the compact bone from the endosteum cylinder. It was impossible with this technique to prevent the tearing or crushing of the endosteum by the instrument or pressure from the splinters. For this reason we employed the following technique: with its periosteal covering, the bone in question (ulna or radius) was exposed. After this, the surrounding soft parts, in the region of the defect, were scraped with a sharp knife and spoon, in order to remove with certainty the small pieces of remaining periosteum clinging to the soft parts. If the nutrient artery was to be retained, the defect was placed distal to the nutrient canal, and furthermore the place of entrance (in the radius and ulna in the middle of the diaphysis and on the ligamentum interosseum, in the tibia in the upper third and behind) was protected, because the periosteum remained in union with the bone and surrounding soft parts for some distance. If the nutrient artery was disturbed, the vessel was torn at the place of entrance through the loosening of the periosteum. The upper and lower ends of the bone to be removed were sawed with a fine saw on the opposite and near side so that the innermost layer of bone was intact. This gave four places where the bone was sawed through almost to the endosteum (two above and two below lying opposite each other), between which the bone and its periosteum were to be removed. In case a larger defect is to be made, the bone is sawed midway between the upper and lower saw lines on the inner and outer side. Now a flat chisel is used and inserted in the saw lines at different places tapping it gently each time, so that the fragment of bone to be removed is not displaced but so that the inner layer of remaining bone is just cracked. In this way the bone with its periosteum can be easily removed without damaging the cylinder of endosteum in any way. There remain the two bone stumps united by the undisturbed cylinder of endosteum containing the marrow. The periosteum on the stumps is scraped off in order to prevent it from taking any part in the formation of bone. After this the soft parts and skin are carefully sutured.

It has been pointed out that on account of the defect the fragments are movable and, as a result, the keeping of the cylinder of endosteum intact is endangered. Certainly this danger is present, but in a series of experiments the danger can be minimized by applying plaster-of-Paris splints, and in another series the danger can be increased by treating the defect without splints. We emphasize especially that we have regarded only those cases worthy of consideration in which the

marrow endosteum cylinder lying free in the bony defect remained undisturbed until the wound was sutured. We are also of the opinion that the delicate cylinder of endosteum and marrow may be damaged by the pressure of the soft parts, through the movement of the fragments and through the play of the muscles. Especially great are these dangers in those cases in which, from the beginning, the extremities are handled without a plaster-of-Paris splint and are allowed to move unhindered. In an injection preparation, Lexer could show, as a result of these conditions, that in contrast to the marked periosteal hyperæmia of the compact bone stumps, the free lying marrow endosteum cylinder was not at all or very poorly supplied with collaterals. These fundamental facts are of great importance for the understanding of the whole process.

In a third series of experiments, we followed the bone building processes in which the periosteum, as well as the marrow and endosteum, was removed from the bone and only the compact bone remained. For this purpose in the middle of the bone to be tested a circular strip of periosteum, 2 centimeters long, would be removed. Then the anterior half of the bone would be sawed off and the marrow and endosteum in this region taken out. In such an experiment there would be a piece of compact bone about 2 centimeters in length completely robbed of its periosteum, marrow, and endosteum, the central and peripheral ends being undisturbed in their union with the remaining bone.

In a series of experiments, the healing processes in total defect of bone were followed. In these cases 2 centimeters of the bone were resected (removal of periosteum, compact bone, endosteum, and marrow), and at the same time the periosteum and the nutrient artery of the stumps destroyed; in other cases these were left intact.

With reference to function, the following holds good for all the experiments. From the beginning, in all cases, we have allowed the bones to have functional rest so that this stimulus plays the same rôle in all the experiments. On the other hand, the stimulus resulting from the voluntary and involuntary action of the muscles, is removed as far as possible by means of a plaster-of-Paris splint which is left in place for 4 weeks. This splint places both of the neighboring joints at rest. When no plaster-of-Paris splint is applied, the joints have full freedom of motion. When the degree of functional rest is the same, we have a series of cases in which healing goes on with the mechanical stimulus removed by means of a plaster-of-Paris bandage during the first weeks of healing, and another series in which the stimulus has not been removed and acts from the beginning, but as a result of the natural splinting afforded by the sound bone parallel to the fractured bone the fragments are given good protection against displacement. All the animals (dogs, cats, and rabbits) bore their weight on the extremities operated upon from the beginning and ran around in 2 to 3 days. For our purpose, we completed only those experiments in which the wound healed by first intention. All the cases were frequently X-rayed in order to follow the regeneration processes. When the animals had a plaster-of-Paris bandage, it was removed in order to take a roentgenogram and was then replaced immediately. At the end of the experiments, which were interrupted at different intervals, the experimental material recovered was carefully prepared and a macroscopic and microscopic examination made.

The results of these experiments will be considered separately under the different headings.

1. THE RÔLE OF THE PERIOSTEUM IN BONE REGENERATION

Our experiments showed that the periosteum plays a most important rôle in the regeneration of bone. It might be concluded that the normal union of the different layers of the periosteum (cambium layer and adventitia) is necessary for bone regeneration.

As a typical example, the X-ray pictures and the histological preparation of such an experiment might be described. With a technique corresponding to our previous description, a circular piece of compact bone together with marrow and endosteum was subperiostially removed from a young rabbit, and at the same time the nutrient artery was destroyed and both marrow cavities were scraped. The periosteum and soft parts were sewed in the usual manner, and

a plaster-of-Paris splint applied and worn for 4 weeks. The roentgenograms (Fig. 1) show the defect immediately after the operation, and 12 and 82 days after operation. Twelve days after operation the two fragments are seen to be united by a continuous shadow, which still shows lighter areas. The radial side of the ulna shows (above the operative area) a long, narrow shadow, which in the region of the operation, is united with a similar long strip of the radius. In the roentgenogram taken 82 days after operation, both bone stumps are united by means of a thick, well formed, callous mass which on the outer side of the radius still shows a concavity. The marrow cavity in this callous mass has not been formed. Radius and ulna are united by means of a bridge-like shadow. In the microscopic preparation (Fig. 2) there is a periosteal, callous mass with an outer layer of compact bone and an inner spongy layer containing newly built marrow spaces. This callous mass is united with the ulna so that the union is scarcely recognizable. The finer microscopic structure of this periosteal, callous mass, just as in the macroscopic, is well formed and the static relationship is already well begun by means of the arrangement of the long lamellar system in the outer layer and by the outspread lamellar system unevenly distributed through the more spongy layer by resorption. In the outer layer, the architectural structure of the newly built cortex is completed; in the inner layer the destruction of the superfluous bone areas is still in process. Through the activity of the osteoblasts and osteoclasts of the regenerating marrow, the marrow canal of the central fragment in the preparation is pushed finger-like into the periosteal callus; in the peripheral fragment the canal is already open and united with the marrow spaces of the periosteal callus. Furthermore, one can see in the preparation how periosteal, callous masses have formed bridges between the radius and ulna. Those bridges are probably formed by mechanical stimulus.

With these bone regenerative processes, no stimulus due to hormones comes into play, as regeneration is possible only because the cambium layer is united with its adventitia which carries the blood vessels and nourishment and thus makes it possible to secure a hyperæmia which reaches the osteoblasts. With bones, it is the same as with all other tissue and organs: life, function, and regeneration are possible only so long as the circulation leading to the tissue in question is intact.

Beside the undisturbed union of adventitia and cambium layer, there is necessary for the same reason, union of the adventitia with the surrounding soft parts. We could show that a periosteal tube separated from its surrounding soft parts could build no bone, but that it showed in all its parts (cambium layer and adventitia) fibrous degeneration.

Here we can also show a typical case. In a young cat, we removed a circular piece of compact bone with the marrow canal and endosteum, we destroyed the nutrient artery and plugged the marrow canals of each fragment with autogenous compact bone, after the periosteum had been loosened on all sides from the soft parts. The ends of the bones in this experiment were united by means of a periosteal tube which was sutured continuously and freed on all sides from the soft parts. Roentgenogram 3 shows the defect immediately after the operation and 2 months later, at which time we find that the atrophic stump ends without any callous formation. In the histological preparation (Fig. 4) one can recognize that bone formation has stopped wherever the outer side of the adventitia has been separated from the soft parts. From here, toward the defect and in the defect itself, there is only a fibrous connective tissue rich in cells, the fibrous elements of the fibro-elastic layer and adventitia, while the cambium layer itself is no longer demonstrable. At the ends of the stumps and in the atrophic plugs, there is present a very meager myelogeno-endosteal callous formation. In the formation of the connective tissue in the defect, in addition to the fibrous degeneration of the periosteum, there is the surrounding nonspecific fibrous tissue.

While the bone-building power of the periosteum of younger animals is generally acknowledged, it is disputed by Bier and his school as in the case of the periosteum of older animals, in so much as the periosteum is not stimulated from the marrow or cortical bone to regeneration by means of a hormone. Contrary to this, we were able to confirm the views of Lexer and others that the bone building powers of the periosteum of older animals is not destroyed, but that it begins in the same way when the conditions for the cambium layer remain the same as in the young animals: its course is, because of the slowing up of all regenerative processes, somewhat slower. In older animals one of the experimental conditions we were not able to retain in the periosteal tubes was the necessary union between the cambium layers and the adventitia. In subperiosteal resection in old animals, the cambium layer remained, for the most part, on the compact bone and so was removed when the bone was removed. As we have already explained, in these cases there was no bone building just as has been reported by other

authors. In these experiments bone building took place only where the periosteum was not separated from the compact bone, and it grew just as in the case of younger animals. In such experiments on old animals we made a histological investigation of the removed cortical bone and demonstrated that everywhere on its outer surface, osteoblasts were present. At the same time small pieces were excised from the periosteum and only occasional cambium cells were demonstrated histologically.

These processes are shown in Figure 5. In an old male cat, we resected subperiosteally from the right radius, a cylinder of compact bone, marrow, and endosteum, 1.5 centimeters long, and sutured the periosteal tube and the soft parts. In Figure 5 we see the defect immediately after the operation and 39 days later. Here the stump is atrophic, but there is no callus formation. Distalward from the incision on the peripheral fragment there is, just opposite the ulna, a small exostosis. Histologically, there are periosteal callosites on the stump ends, while in the defect there is a fibrous scar which closes the marrow canal.

It is to be expected, that in old animals, when it is technically impossible to keep the cambium layer in union with the adventitia, periosteal bone regeneration in the defect will not occur. In histological preparations of such cases, there is found, as explained, periosteal bone building on the outer surfaces of the stumps. From this there would seem to be special relationships or conditions present. In such experiments one should remember that conditions are produced which correspond only in part, or not at all, with natural or normal conditions. The negative results in these cases are the opposite to those found in bone healing in older people, in whom just as in young people, there is a marked periosteal callus formation, although the process is somewhat slower. An injury which produces a fracture never causes so marked a separation between the cambium layer and the adventitia as occurs in experiments in which a subperiosteal resection is performed in older animals. The natural union of both layers remains, entirely or almost entirely, intact in the largest number of cases.

If we compare these results with our experiments, we find that even in old animals, when the natural contact between the cambium layer and adventitia is maintained, periosteal bone regeneration takes place exactly as it does in young animals, only the process is slower.

To illustrate, the pictures of an experiment may be described. In this experiment, a periosteal tube was made which had small splinters of the cortex hanging to it. Figure 6 shows the defect immediately after operation and 6 and 11 weeks later. The single splinters are seen in the defect. The periosteal tube united the two stumps as a bridge. The ulna broke while putting on the plaster-of-Paris bandage. Six weeks after operation the fracture of the ulna had united by means of a massive callus. The radial fragments which were separated about 0.5 centimeter were united only on the ulnar side by means of a united callous mass, which at the central fragment is united with the callous mass of the ulna. On the outer side of the radial fragments, there are massive deposits of callus which do not unite but leave a space about 2 millimeters wide. Eleven weeks after operation we found a thick, continuous shadow in the region of the ulnar fracture and between the radial fragments. The radial fragments were embedded in the callus and were definitely recognized as such. They stood about 0.5 centimeter apart and this defect was filled with a callous mass. At the edge of the distal defect, there was in the radial callus, a small separation extending to the compact bone. Histological examination of the preparation showed that the defect of the radius was filled by a periosteal callus arising from the periosteum of the radius.

In this place we would mention that the same conditions are of importance in the free transplantation of periosteum. If the periosteum in old animals is transplanted, only the adventitia is used as has been previously explained, and as the adventitia lacks osteoblasts, it does not regenerate bone. Of this we have been able to convince ourselves many times in transplanting the periosteum in old individuals (that is adventitia alone). When the periosteum in young animals is transplanted and the proper technique is used bone is always present, as the cambium cells remain hanging on the periosteum. An example showing the bone-building power of the periosteum in old animals when the above mentioned conditions are present follows:

In a man of 60 years, the opportunity was presented during an operative reduction of a 20-day-old fracture of removing a small piece of thickened periosteum from the fracture end where it was possible to remove it easily from compact bone. This piece of periosteum

was transplanted subcutaneously and 14 days later removed. It was completely healed in and united with the surrounding tissue and had macroscopically built bone. In microscopic preparation (Fig. 7) one can see everywhere in the periosteum, which is rich in cells, marked osteoid and bone formation which extends into the hyperæmic surrounding tissue rich in cells. The periosteum and its cells are united with the subcutaneous tissue of its bed by means of a granulation tissue. Here we have good bone reproduction with an autogenous piece of periosteum (with the cambium layer retained) in the subcutaneous fatty tissue in an old man.

A further proof is found when a nose is made by transplanting an autogenous, periosteal covered piece of bone from the tibia. The bone is first transplanted free into the subcutaneous tissue of the arm. In such cases, according to Lexer, the bone when transplanted free in the soft parts, quickly begins active building and destruction and everywhere the osteoblasts of the periosteum and also the endosteum form new bone.

Figure 8 is from such a case of nose plastic. A section of a small piece of bone was taken from the healed-in bone 4 weeks after the implantation in the upper arm. The processes mentioned above can be recognized readily. Especially noticeable is the definite covering of the bone on its periosteal side with a layer of intensely colored, typical osteoblasts and, in addition, in the marrow spaces are areas of erosion caused by giant cells which lie scattered in the deep bone.

To secure bone production by means of the periosteum it is necessary to maintain the natural union of both layers of the bone and also to retain its osteoblastic layer. According to Lexer the adventitia plays a secondary rôle; it offers the osteoblast nourishment and protection; stimulus for bone formation does not come from it.

We were successful in all experiments in young and old animals, when we followed the conditions laid down in the beginning, and we obtained from the periosteal tubes functionally normal regeneration which approached anatomically very near the normal. In these cases the inner architectural structure of the new bone assumed early the static relationship (compact bone with the lamella in the outer layer running longitudinally, the spongy bone with irregularly arranged lamella and marrow spaces, see Fig. 2.) In the regeneration of bone from a periosteal tube, the endosteum expends its energy in forming a new marrow canal in the periosteal callous mass, and it is through the activity of the osteoblasts and osteoclasts that the new marrow canal is made (compare Fig. 2).

We were also able to determine that from partly retained periosteum there is sufficient bone regeneration to be of functional use.

A young rabbit was operated upon with the usual technique, and a cylinder of compact bone and marrow canal was removed. At the same time a half circle of the periosteum was removed and the marrow canals of the stumps were curetted. Figure 9 shows the defect (immediately after and three months after operation). Three months after operation, both stumps were united by a uniform bone shadow which on the outer side showed a concavity. Radius and ulna were united by means of a bridge-like callus. Histological examination showed a filling in of the defect by means of well formed bone from the retained periosteum. The outer layer is of a compact structure, the inner layer is spongy. In this case histologically there is also a new formation of periosteum where the periosteum was operatively removed.

In our experiments we were able to substantiate the powerful regenerative action of the periosteum. Periosteal defects regenerate in the shortest time either from the cut edges of the remaining periosteum or from the islets of remaining periosteum, and finally from the endosteum of the haversian canals lying superficially in the cortex, provided the place of periosteal regeneration is not closed up by the early proliferation of the surrounding unspecific connective tissue. From such periosteal regeneration, bone defects in which the periosteum has been operatively removed and in which the remaining bony tissue has been removed (as numerous experiments show), can be united in a very satisfactory anatomical and functional way (experiments with endosteal cylinders, see below). The periosteum has such an ability to regenerate and build bone that its thorough destruction would be necessary to prevent bone formation. In all the experiments in which the periosteum was removed but the remaining bony structures were kept intact, and in which there was a total loss of periosteum, compact bone, marrow and endosteum, the periosteum in a short time forced its way through in all directions.

Only through the early overgrowth of nonspecific connective tissue or through the destruction of the blood supply was periosteal regeneration destroyed.

Because of the quick regenerative power of the periosteum even in periosteal defects, a great many mistakes are made in judging the results in experiments, especially in determining the bone building power of the endosteum and marrow cylinder after the periosteum and compact bone have been removed. In roentgenograms there are often seen in such experiments, even in the middle of the defect, shadows of bone; under certain conditions the whole defect may be bridged by such a shadow (compare Figures 15 and 16). One might regard this bone building as myelogeno-endosteal, but careful microscopic examination explains this and shows definitely the periosteal origin of the callus. Therefore we see how important the periosteal regeneration, coming from the periosteal edges, is in the healing of defects. (See 15 and 16.) An exact histological examination of the preparation is necessary before conclusions can be drawn; roentgenograms may lead to error.

The influence of an *early static stimulus* does not disturb periosteal bone regeneration. It has a stimulating influence only on the early architectural structure of the regenerated bone (a sort of outer compact bone, and an inner spongy layer). On the other hand, the process of regeneration is delayed if further mechanical stimuli are present, such as the free use of the extremity (no plaster-of-Paris splint from the beginning) with voluntary and involuntary muscle functioning, and the result is a distortion, pressing, rubbing, and rotation of the fragments. The bone formation in the callous mass shows in its length the result of these untoward influences.

These relationships will be demonstrated by means of roentgen pictures of an experiment. In the usual manner, as previously explained, a subperiosteal resection of a piece of radius was done. In Figure 10 the defect is seen immediately after operation, 11 days, 3 and 4 weeks, and 83 days after operation. Eleven days after operation exuberant callus is seen at both ends of the stump in the vicinity of the proximal fragment, which shows a separation going through the callus. After 3 weeks, the callus is thicker and stronger. At the proximal fragment the callus has spread itself out plate-like and at the distal fragment it has the form of a joint head. Between the fragments is a wide space. After 4 weeks the roentgenogram still shows the separation, but the space is much smaller. Finally after 83 days, the roentgenogram shows the two fragments united by means of a continuous callus, which on the outer side of the proximal fragment seems to be loosely built. Histological examination shows the defect to be filled by a large periosteal callus which, however, does not as yet show such advanced architecture as was shown in another experiment which was observed the same length of time. The whole callus is more spongy, and shows instead of early fissure formation early callous formation in the form of embryonic tissue and islets of cartilage.

Lexer's principle, "incomplete fixation in the first weeks until the hyperæmia of the fracture has subsided" is fully substantiated in these animal experiments.

2. THE RÔLE OF THE MARROW AND ENDOSTEUM IN BONE REGENERATION

During our experiments the overwhelming importance of the periosteum in bone regeneration was shown, and from this we can infer that the rôle of marrow and endosteum in bone regeneration is much smaller. We could show that bone is built by the marrow and endosteum in so much as the nourishing blood vessels (the nutrient artery and its intraosseous anastomoses) are intact. With these intact bone formation begins in the marrow spaces and grows into the defect. There develops in the experiment (retained cylinder of marrow and endosteum with an absence of periosteum and compact bone), from both marrow canals more or less bone regeneration growing out mushroom-like which is not able to unite itself. Between the two there remains in the middle of the defect a space filled with a connective tissue of the degenerated marrow and endosteum, and connective tissue from the immediate surrounding; *thus a pseudo-arthrosis constantly results.*

Figure 11 shows the regenerative processes in a young rabbit in which a periosteal and cortical defect was made in the right ulna and the marrow and endosteum and its nutrient artery retained. The periosteum was scraped from the stumps for a distance of 1.5 centimeters. A plaster-of-Paris bandage was applied. Immediately after operation we see two fine line-like bone splinters; 12 days after operation we see light cloudy layers on the inner sides of the

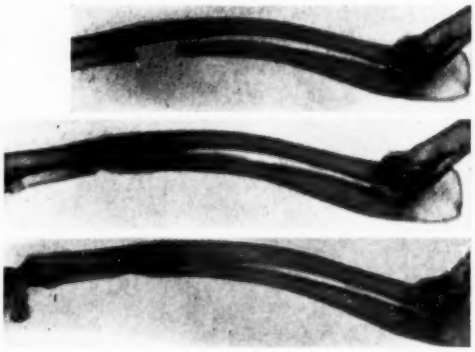

Fig. 1. Circular compact bone, marrow and endosteum defect of ulna in young rabbit. Artery destroyed and marrow canal curetted. Roentgenograms taken immediately after operation and 12 and 82 days later.

ulnar fragments of the radius. The stump ends and the defect show no callus. After 32 days the roentgenogram shows the light shadow of the stumps and, on the ends like a mushroom, peripherally and centrally, a 2 centimeter long irregular, callus shadow. The defect is not bridged by the callus mass. There is a bridge-like callus between the central ulnar fragment and the radius and a small exostosis on the radius opposite the peripheral ulnar fragment. From the histological picture, Figure 12, one can see how extensive myelogeno-endosteal bone building has taken place at the end of both marrow canals, has grown out a short distance and, for the most part, closed the canals. Toward the defect the border of osteoid cells of this callus blend into a compartment-like connective tissue, rich in cells, reaching out in all directions, which as yet has not formed the precallous stage. The blood supply of this connective-tissue-like marrow and endosteum part becomes more sparse outside of the callous ridge. Taking part in the forming of connective tissue of the defect is the unspecific connective tissue of the surrounding parts with innumerable cells and blood vessels. Opposite the peripheral fragment and its myelogeno-endosteal callus, is a periosteal callus mass of the radius and, by means of cartilage, this is united with the ulnar fragment (mechanical influence of movement). Some distance from the stump end, the periosteum has regenerated and formed a callus.

Similar but much farther advanced processes are found in experiments which were followed for a longer time in a young, large dog, in which in the usual manner, a 2.5-centimeter piece of periosteum and compact bone was taken from the right ulna with the marrow and endosteum intact. The periosteum was removed from the fragment and the nutrient artery saved; plaster-of-Paris dressing was applied and worn for 4 weeks. Figure 13 shows the defect immediately after the operation, and 3 and 10 weeks after operation. A cloudy shadow, about

Fig. 2. Drawing of section of bone in experiment shown in Figure 1 showing *P. C.*, periosteal callus in defect; *X. Y.*, site of operation; *D. F.*, distal fragment; *P. F.*, proximal fragment; *U.*, ulna; and *R.*, radius.

7 millimeters long, is seen on both of the fragments 3 weeks after operation. After 10 weeks, the roentgenogram shows the shadow more compact and somewhat larger. The defect not yet filled by callous mass, is about 8 millimeters in length. The histological preparation (Fig. 14), shows both marrow canals completely closed by the myelogeno-endosteal, spongy, callous mass. These callous masses quite markedly overreach the edges of the defect on both sides; however, they do not touch one another, but between them is a space of about 8 millimeters which is filled with connective tissue. This connective tissue of the defect arises partly from the endosteum and partly from the surrounding connective tissue. The outer surfaces of the bone stumps have no periosteum and are covered by the immediate surrounding connective tissue. At a distance from the place of operation, the periosteum has regenerated on the bone ends, just as in the cases mentioned before.

While from the marrow and endosteum cylinders only an incomplete filling of the defect with bone took place, we could show in our experiments that from the periosteal rests a

Fig. 3. Circular bone marrow and endosteum defect of radius in young cat. Artery destroyed and marrow canal plugged with living autogenous bone. Roentgenograms taken immediately after operation and 2 months later.

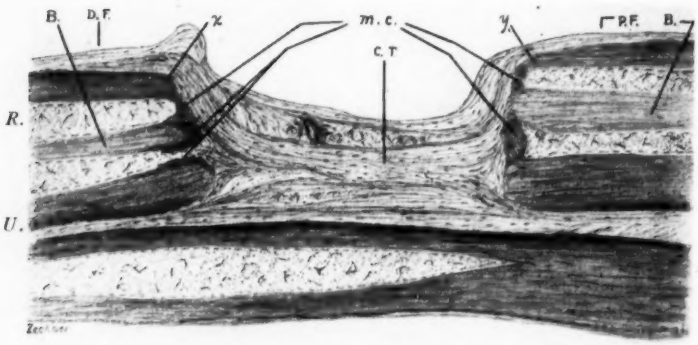

Fig. 4. Drawing of section of bone shown in Figure 3, showing *B.*, compact bone; *D. F.*, distal fragment; *X. Y.*, site of operation; *C. T.*, connective tissue of defect (periosteum and connective tissue of vicinity); *M. C.*, callus of marrow canal; *P. F.*, proximal fragment; *R.*, radius; *U.*, ulna.

marked bone regeneration may take place, and under certain conditions, may lead to bony union of the stumps. Periosteal regeneration occurs especially in experiments in which the periosteum has not been thoroughly scraped from the ends of the stumps. To demonstrate this, we have a series of experiments, one of which will be described below (Figs. 15 and 16). In the two cases illustrative of marrow and endosteum cylinder, the periosteum was removed for some distance from the stump ends in order to exclude the periosteal regeneration; but in spite of this the periosteum regenerated partly, even though it did not reach the field of operation. We wish to point out that such periosteal regeneration must be sharply differentiated from the myelogeno-endosteal regeneration.

The bone building processes from the marrow and endosteum add bone to the compact bone at the end of the marrow canal. Here the stiff walls of bone protect the extremely delicate marrow and endosteum from mechanical influences and, at the same time, exclude the damaging influence of such stimuli upon

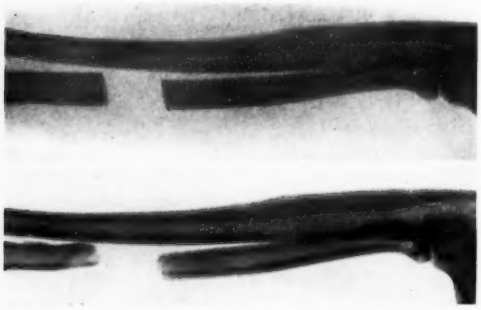

Fig. 5. Circular compact bone and marrow and endosteum defect in radius of old male cat. Artery of proximal fragment retained; of peripheral fragment destroyed. Roentgenograms taken immediately after operation and 39 days later.

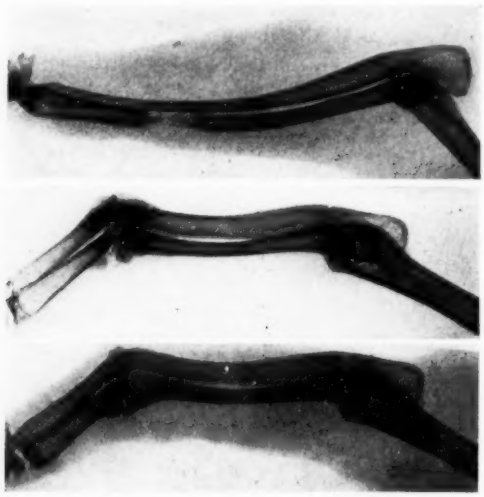

Fig. 6. Circular compact bone defect with destruction of nutrient artery and curettement of marrow canals in the radius of an old rabbit. These roentgenograms were taken immediately after the operation and 6 and 11 weeks later.

Fig. 7. Free autogenous transplant of thickened living periosteum from a 20-day fracture in man of 60 years. This section was made 14 days after the piece of periosteum had been transplanted into subcutaneous fatty tissue. Marked bone formation from the periosteum is evident.

Fig. 8. Free autogenous transplant of living compact bone and periosteum from the tibia into the subcutaneous tissue, in a nose building operation in a man of 25 years. Four weeks after operation there is marked building and destruction of bone. *O.*, Osteoblasts; *P.*, periosteal osteoblasts.

hyperæmia and callous formation. Since the bone formation sets in just at the end of the marrow canal, the nutrient arteries at this place are gradually compressed and are soon shut off. For this reason the blood supply to the marrow and endosteum, lying outside of the marrow canal, is decreased, even before bone building can begin. The supply of nourishment is completely cut off as soon as the marrow canal is completely closed by the callous mass. A result of these processes is the forming of pre-callous masses from the marrow and endosteum which set in later near the middle of the defect. In the middle of the defect, for reasons previously stated, the decreased blood supply makes itself evident even before further development of the callous masses takes place.

Now we know that the delicate callous masses are hindered in forming bone when nourishment is interfered with through mechanical stimuli. Such mechanical stimuli are not entirely prevented due to the nature of the experiments, even when plaster-of-Paris bandages are applied. Even the continuous pressure of the surrounding soft parts and muscles as well as the slight movement (impossible to prevent) of the fragments, causing laceration and rubbing of the cylinder of marrow and endosteum and its blood vessels, is sufficient in this extraordinarily sensitive cylinder of endosteum and marrow to cause tearing of the nutrient blood vessels, hæmorrhages, necrosis, or even tearing and breaking off of the cylinder of endosteum and marrow. If the cylinder of endosteum and marrow is not damaged from the beginning by these things and callous masses form in the defect, the callous masses will degenerate into connective-tissue degeneration products as a result of the poor nourishment due to the diminution of the blood supply caused by the unpreventable mechanical stimuli. The marrow callus, as a result of its early development in-

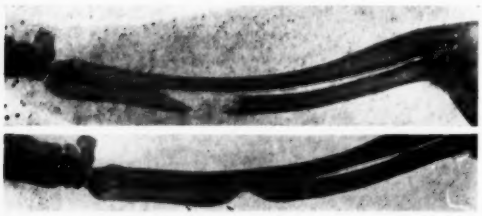

Fig. 9. Circular compact bone and marrow and endosteum defect in radius of young rabbit. Nutrient artery destroyed and marrow canal curetted. Roentgenograms taken immediately after operation and 3 months later.

side the marrow canal, protecting its regenerative processes from mechanical influences, digs its own grave; the callus walls up the marrow canal too early.

Therefore much myelogeno-endosteal bone formation occurs at these places where the nourishment from the nutrient arteries remains undisturbed, and the hyperæmia, as a result of this, can work sufficiently long. If the hyperæmia is shut off too early, or is not present at all, every trace of bone regeneration is absent in these places. With Lexer we believe that the reason for this lies only in the damaging mechanical influences on the poorly nourished callous masses, as we know that where free pieces of marrow canal tissue are transplanted, the bone building parts are nourished through ingrowing embryonic tissue of the host and that they form pieces of bone, which, in the course of time, as a result of lack of function, are again absorbed. Between the periosteum and endosteum with reference to their bone regenerating power, there is fundamentally no difference. The early disturbance of the bone regenerative power of the marrow and endosteum takes place, first, because the sensitive marrow and endosteum is easily damaged; second, being easily damaged, mechanical stimuli do so much more damage; third, the interference with the blood supply since the blood supply runs through the middle of the marrow and endosteum cylinder. The periosteum on the other hand has the bone formed on its inner side, the adventitia and the blood vessels entering from the outside; as a result of this, the bone building processes are not disturbed.

But the mechanical stimuli cannot be excluded from working on the most easily dam-

Fig. 10. Circular compact bone and marrow and endosteum defect of radius in young rabbit. Roentgenograms taken immediately after operation and 11 days, 3 weeks, 4 weeks, and 83 days later.

aged part of the defect—the middle—even if a plaster-of-Paris bandage is applied. As a result there are hæmorrhages, necroses, or even a breaking of the continuity of the marrow and endosteum cylinder. In these damaged places granulation tissue from the surrounding unspecific connective tissue replaces the damaged tissue, and, indeed, this happens early before the specific marrow and endosteal regeneration can set in at the stump ends after the development of the hyperæmia of the fracture. Furthermore, the granulating tissue of the immediate vicinity, growing into areas not traumatically damaged, carries unspecific connective-tissue elements with the precallous states of the marrow endosteum cylinder and so helps to promote their change into connective tissue. In one way or another there appears in the defect, especially at greater distances from the edges, areas of callous forma-

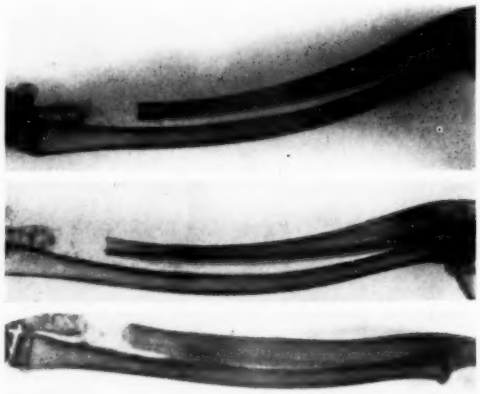

Fig. 11. Circular compact bone and periosteum defect of ulna in young rabbit. Periosteum scraped off 1.5 centimeters on stumps. Roentgenograms taken immediately after operation and 12 and 32 days later.

tion poorly nourished, or areas or unspecific connective tissue of the immediate vicinity, which on account of the continual actions of mechanical stimuli, lead to complete replacement by connective tissue and therefore to a pseudo-arthrosis.

Where the blood vessel supply is intact the condition necessary for bone regeneration in a marrow endosteum cylinder is unfavorable. The conditions become especially bad when the nutrient artery is destroyed. The hyperæmia in such cases cannot develop at the proper time, but develops only when the collateral circulation in the marrow endosteum cylinder has developed. According to the investigations of Lexer, these processes take about 4 to 5 weeks. In this time the marrow canal in the defect is closed, either by the periosteal regeneration and bone formation, if the periosteum has not been thoroughly removed, or from the connective tissue of this region. For these reasons the delayed callus of the marrow and endosteum cannot develop. Increasing the time of fixation is not necessary in as much as a bridging of the defect takes place from the periosteum. The myelogeno-endosteal bone formation results in such cases only inside of the marrow canal. In comparison with the cases in which the nutrient vessel is intact, the myelogeno-endosteal bone regeneration is very little.

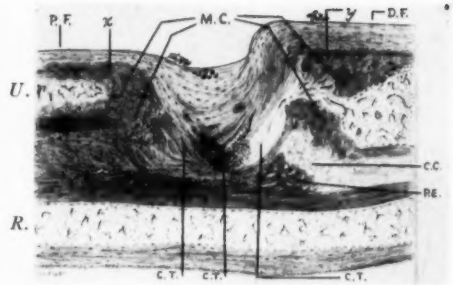

Fig. 12. Drawing of section of bone from same experiment as shown in Figure 11. *P. F.*, Proximal fragment; *X.Y.*, site of operation; *M. C.*, myelogeno-endosteal callus; *D. F.*, distal fragment; *C. C.*, cartilaginous callus between marrow callus of ulna; *P. E.*, periosteal exostosis of the radius; *C. T.*, connective tissue of defect and surrounding tissue; *U.*, ulna; *R.*, radius.

As an example of these conditions we will show the pictures of a young rabbit in which a cylinder of compact bone and periosteum retaining the marrow and endosteum, was removed from the ulna and the nutrient artery destroyed. The periosteum was scraped from the ends of the stump 0.5 centimeter in length. The wound was sutured and a plaster-of-Paris bandage put on and worn for 4 weeks. Figure 15 shows the condition immediately after operation, 15 days later, and 6 and 10 weeks after operation. After 15 days there were shadowy depositson the outer surfaces of the compact bone, but not on the incised area of the marrow canal. On the inner side of the radius there is a bowlike, roughened, callous mass. After 6 weeks the shadowy layers on the outer side of the compact bone of the radius and ulna are united. After 10 weeks the defect is more completely filled out with callus, except on the outer side of the ulna where there is still a small place not filled out. From the histological picture (Fig. 16) one can recognize by comparing with earlier cases (Fig. 12 and 14) the extraordinarily slight myelogeno-endosteal callous formation at the ends of the marrow canals, which are slightly covered by the callous formation, and toward the defect are beginning to be closed off. In a very definite way one can see the great vicarious periosteal regeneration and callous formation which has filled the whole defect. The inner structure of the periosteal callus is already far advanced (compact-like structure on the outside, spongy structure inside). At the same time one can see, that at the peripheral fragment and in the defect, the periosteal blood vessels which are forcing their way through the callous mass, are taking part in the vascularization of the marrow canal.

In a series of experiments with intact marrow and endosteal cylinders in which the nutrient artery was destroyed, the unspecific connective tissue of the surrounding structure

Fig. 13. Circular compact bone and periosteum defect of ulna in young dog. Periosteum scraped off 2 centimeters on stumps. Roentgenograms taken immediately after operation and 3 and 10 weeks later.

grew more or less into the marrow canal. In such cases bone formation may take place as a result of the delayed regeneration of the marrow and endosteum, where the infiltrating connective tissue stops, that is more or less deep in the marrow canal.

The process of bone regeneration is slower in older animals than in younger animals. Unlimited mechanical stimulation which results from a free use of the limb (no plaster-of-Paris splint) from the beginning damages quite markedly the sensitive marrow and endosteum and as a result much less callus is formed than in animals in which this damaging mechanical stimulus is reduced as much as possible by means of plaster-of-Paris bandages. Furthermore, the free use of the extremities in the first weeks (no plaster-of-Paris splint) has a delaying influence upon the bone formation in the early callous tissue.

3. THE RÔLE OF COMPACT BONE IN BONE REGENERATION

From our experiments we can conclude that compact bone, inasmuch as it is robbed of its periosteum and marrow and endosteum, and by this of its nourishing blood vessels, is attacked by the infiltrating connective tissue from the immediate vicinity and becomes porous. If nourishment is not very quickly supplied from the neighboring periosteum or marrow and endosteum, spontaneous fracture will result in such pieces of compact bone, especially under the influence of function and weight bearing. The *cortex denuded of periosteum and marrow and endosteum does not take part in bone formation.* On the other hand, we could prove that as the denuded compact bone was again nourished, periosteal regeneration and bone formation took place from the osteoblasts of the haversian canals.

As proof of these statements we wish to present the roentgenograms of a case in which the periosteal covering of the tibia was entirely removed. From this piece, free from periosteum, the front wall of bone together with the marrow and endosteum was removed. In this case, for a distance of about 2 centimeters there was only the posterior shell of compact bone free of periosteum, marrow, and endosteum. It remained undamaged while the fibula was bent in. The wound was sutured and no plaster-of-Paris bandage applied. Figure 17 shows the condition immediately after the operation, the defect of the anterior tibial wall and, opposite the shell of compact bone of the tibia, a horizontal fracture line in the fibula without dislocation. The posterior shell of compact bone of the tibia is not fractured. After 7 days (Fig. 17) small callous masses can be seen on the outer surface of the lower edge of the compact bone; the posterior shell of the compact bone shows nothing of especial interest. After 16 days (Fig. 17), one can recognize the callous formation on the tibial fragments spontaneously fractured. Between fibula and tibia there is a callous bridge. Histological examination showed the atrophic and degenerated posterior shell of the cortex and callous formation only when periosteum, marrow, and endosteum were retained; therefore only to the base of the shell of the compact bone.

As a further example, we wish to show the roentgen pictures of a case where a 2.5 centimeter piece (periosteum, compact bone, marrow, and endosteum) was sawed out of the radius and, at the same time, the nutrient arteries were destroyed and the periosteum on both stumps removed to the joint ends (total defect). The wound was sutured, and a plaster-of-Paris bandage applied and worn for 4 weeks.

Figure 18 shows the defect immediately after the operation and 4 weeks and 19 weeks later. After 4 weeks the stump ends show a washed out lighter shadow and no callus. After 19 weeks the stump ends are irregular points and show a high grade atrophy, but no callous formation. Microscopic examination showed a defect filled with connective tissue and an atrophic cortex which was surrounded by unspecific connective tissue from the neighborhood. At isolated places one could see small periosteal islands, which had developed on the outer surface of the bone growing out from the haversian canals beneath the connective tissue.

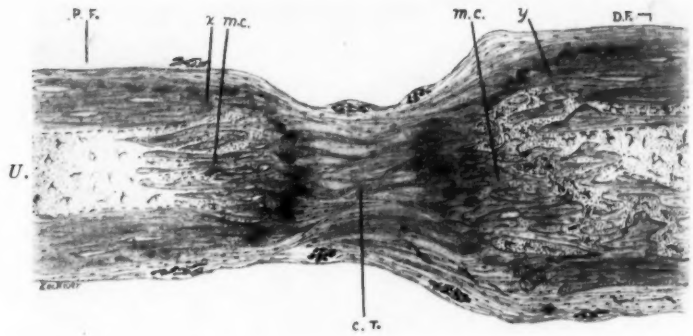

Fig. 14. Drawing of section of bone from same experiment as shown in Figure 12. *P. F.*, Proximal fragment; *X.Y.*, site of operation; *M. C.*, myelogeno-endosteal callus; *D. F.*, distal fragment; *C. T.*, connective tissue of defect (marrow and endosteum and connective tissue of vicinity); *U.*, ulna.

4. CIRCULATORY SYSTEM AND BONE REGENERATION

This question can be answered only in connection with sections 1 and 3. In a résumé, the following will again be stated. Every bone regenerative process is intimately associated with an undamaged blood supply to the osteoblasts and at the seat of the lesion with a fracture hyperæmia setting in at the right time and continuing undisturbed for a sufficient length of time. If the circulatory supply is primarily damaged, or in the course of the regenerative process too early destroyed, bone regeneration does not take place. Such damaged parts, especially under the influence of undesirable mechanical stimuli, are replaced, to a certain extent, by the degeneration of the part and partly by the connective tissue of the immediate vicinity.

Damaging the blood supply leads to pseudarthrosis. Conditions are unfavorable with reference to marrow and endosteum, even when operatively the blood supply is retained. Through its own callous formation at the ends of the marrow canals, the ends of the marrow and endosteal tubes, lying in the defect, are early cut off from their source of nourishment. In substantiation of Lexer's findings we could prove that, after damage to the vascular supply of the marrow and endosteum, the periosteal circulation takes a part in furnishing a new supply, in that perforating blood vessels grow through the callous mass or through its own callous mass into the marrow canal. (Fig. 16.)

5. BONE REGENERATION AND CONNECTIVE TISSUE

In our experiments we could prove the viewpoint of Lexer, that the connective tissue may be derived from two sources: first, from the connective tissue of the periosteum, marrow, and endosteum; second, from the immediate surrounding connective tissue.

We have already explained that the periosteum as a whole, when it is separated from its source of nourishment (blood supply), undergoes connective tissue degeneration. As a result of cutting off the fracture hyperæmia it cannot reach the cambium layer at the right time, and the cambium layer is badly damaged and can build no bone. In such cases the stump ends are covered by connective tissue resulting from the periosteal degeneration while the defect itself is bridged by this connective tissue (Fig. 4). In the same manner the adventitia and the connective tissue of the fibro-elastic layer can hinder the bony union and bridge the defect by means of a connective tissue strand, if the cambium layer is separated from the adventitia and fibro-elastic layer (periosteal tube, old animals, Fig. 5). The gradual pushing forward of the callous formation, which in such cases comes from the cambium layer which has retained its normal relationship, blocks, in one way or

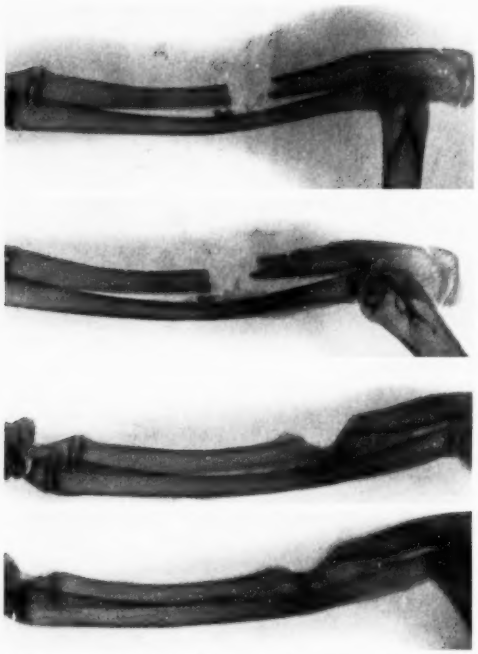

Fig. 15. Circular periosteum and compact bone defect of ulna in a young rabbit. Periosteum scraped off stump ends 0.5 centimeter. Roentgenograms taken immediately after operation and 15 days and 6 and 10 weeks later.

another, the previously formed connective tissue of the periosteum because it sinks into the small corners, holes, and the defect early and fills them out. The adventitia grows if the regeneration of the cambium layer is interrupted by hæmorrhage or the too early closing off of the compact bone through the unspecific connective tissue of the surrounding tissue, forming a covering over the stump ends. The mushroom-like callus of the marrow and endosteum plays a part in the formation of the connective tissue of the defect. In the same manner the adventitia may cover up the marrow canal or grow into it, if a myelogeno-endosteal callous formation does not take place at the right time. At places of especial mechanical stress, the connective tissue-like stages of periosteal callus remain a long time and develop fissures which are gradually replaced by bone (Fig. 10).

From the marrow and endosteum, connective tissue develops in places where the nourishment is limited, or in those places where damage has resulted to the marrow and endosteum or its blood supply by undesirable mechanical stimuli. Under the influence of such disturbance, bone formation does not take place in the already formed precallous tissue. From the marrow and endosteum there develops into the defect, because of impairment of the blood supply of the nutrient artery, a tissue, rich in cells, which gradually changes to a fibrillary connective tissue. These same processes take place in the marrow canal, if the nutrient artery is destroyed during operation. In such cases, connective tissue formation begins deep in the marrow canal, and extends out of the canal and advances into the defect. Developing in one way or another, such myelogeno-endosteal connective tissue takes part in the formation of the connective tissue of the defect (Figs. 12 and 14).

This connective tissue resulting from degeneration of the different tissues of the bone is increased through connective tissue which arises from the unspecific connective tissue of the surrounding region. Where larger periosteal defects, destruction of the cambium layer, or damaging of the circulation hinder beginning regeneration at the right time by the specific bone building cells, the unspecific connective tissue of the immediate area grows too early into the spaces (Figs. 4 and 5). Especially is this the case when at the same time damaging mechanical influences may be present. Thus the unspecific connective tissue of the vicinity unites with the connective tissue degeneration of the periosteum, as explained above, as an obstacle to bone formation. Where the periosteum is loosened or removed from the compact bone, the blood and lymph vessels of the vicinity become organized by the connective tissue, so that at a later stage the outer surface of the bone is everywhere attacked by granulations and covered by the usual connective tissue (Figs. 12, 14, 17, 18 and 20). In such cases the unspecific connective tissue of the vicinity, because it develops earlier than the processes of bone regeneration, is a hindrance to regeneration and bone formation. At these places the incompletely regenerated cambium layer overcomes for a short

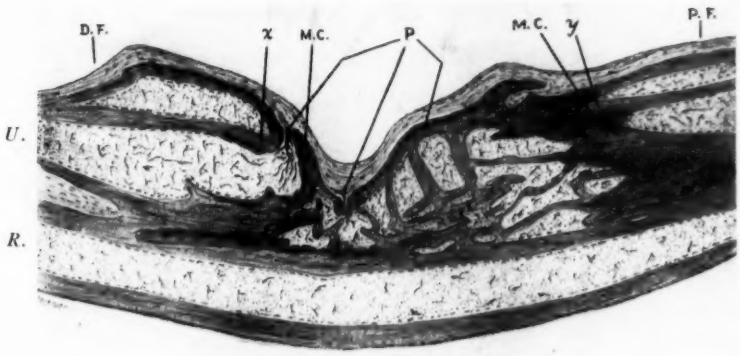

Fig. 16. Drawing of section of bone in same experiment as that shown in Figure 15. *D. F.*, Distal fragment; *X. V.*, site of operation; *M. C.*, myelogeno-endosteal callus; *P.*, regenerated periosteum with callus and periosteal blood vessels; *P. F.*, proximal fragment; *U.*, ulna; *R.*, radius.

distance the unspecific connective tissue; a useless attempt of the unspecific bone regeneration, which results in a victory of the connective tissue and the destruction of the osteoblasts. The unspecific connective tissue of the vicinity wanders far into all the defects of the marrow and endosteum (Figs. 17, 18, 20) and organizes the blood and lymph present there. In this early developed connective tissue, specific bone regeneration by the marrow and endosteum finds an unsurmountable difficulty. Furthermore, we could prove that, with an intact cylinder of marrow and endosteum, the part of the cylinder in the defect is replaced partly by connective tissue developed from itself and partly from granulating tissue of the vicinity (Fig. 12, 14). For the most part it is the damage of the marrow and endosteum as a result of cutting off its blood supply, in addition to damage, hæmorrhage and necrosis, as a result of being easily damaged, which causes the growing in of unspecific connective tissue in the vicinity of the damaged places. In later stages the fibers coming from the marrow

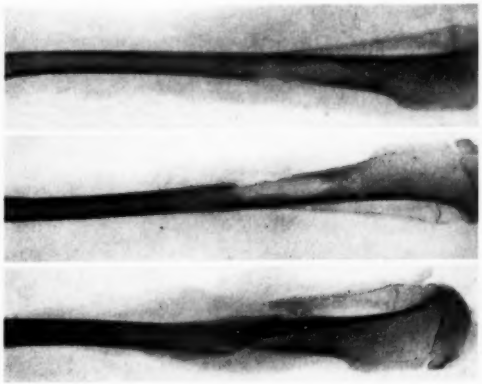

Fig. 17. Periosteal covering and marrow and endosteum defect of tibia in young rabbit. Fracture of fibula opposite intact shell of tibia. Roentgenograms taken immediately after operation and 7 and 16 days later.

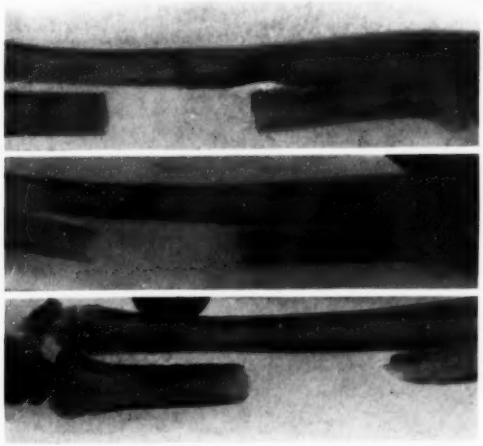

Fig. 18. Showing the total defect of the radius (2.5 centimeters) in a young cat. These roentgenograms were taken immediately after the operation and 4 and 19 weeks later.

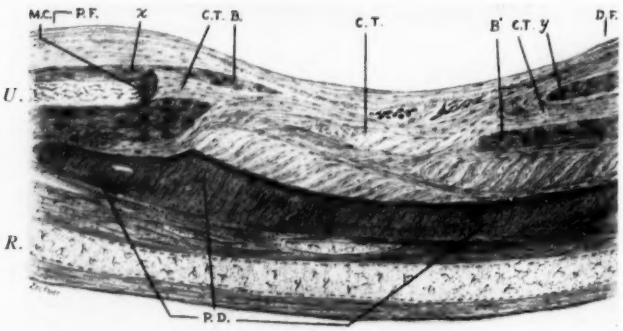

Fig. 20. Drawing of section of bone in same experiment as shown in Figure 19. *P. F.*, Proximal fragment; *X. Y.*, site of operation; *C. T.*, connective tissue of defect and of vicinity; *B.*, compact bone; *D. F.*, distal fragment; *P. D.*, periosteal radius defect; *M. C.*, myelogeno-endosteal callus; *U.*, ulna; *R.*, radius.

and endosteum, from the periosteum, and from the connective tissue of the vicinity permeate everywhere, so that the defect is completely filled by a firm scar tissue coming from different places. As a result of connective tissue degeneration of the bone building tissue itself, or as a result of its replacement by the non-specific connective tissue of the vicinity, pseudo-arthrosis develops, the latter, however, is due to nutritional disturbance of specific bone-building parts or due to far reaching damage and separation of its osteoblasts.

If the nutrient arteries are intact and cause the myelogeno-endosteal bone building to set in at the right time, the mushroom-like callous masses will be covered under certain conditions by non-specific connective tissue of the vicinity together with periosteal connective tissue (Fig. 12, 14). The fibrous degenerated remains of the marrow and endosteum lying between mushroom-like calluses of the marrow unite with the periosteal and unspecific connective tissue and form a connective-tissue bridge between the incompletely regenerated bone stumps. If the nutrient arteries are destroyed, the connective tissue of the vicinity granulates into the marrow canal and fills it, more or less, before a myelogeno-endosteal callous formation can take place after the collateral circulation has developed and started regenerative processes. Finally, after development of the collaterals, we have seen delayed callous formation in small amounts, from the marrow and endosteum. In its further growth the callous formation will be hindered by the previously developed masses of connective tissue. In such cases, with destroyed nutrient arteries but with intact cylinders of marrow and endosteum, the replacement with unspecific connective tissue of the vicinity goes so far that not a trace of marrow or endosteum can be demonstrated in the defect. As a result of the destruction of the blood vessels in such cases, the marrow and endosteum remain only deep in the marrow canal and otherwise are replaced by the non-specific connective tissue of the vicinity.

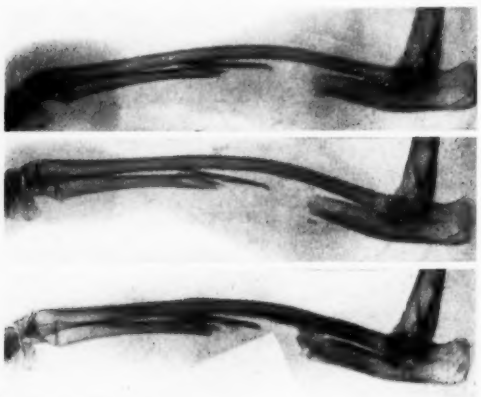

Fig. 19. Total defect of ulna in young rabbit. Roentgenograms taken immediately after operation and 8 days and 1 month later.

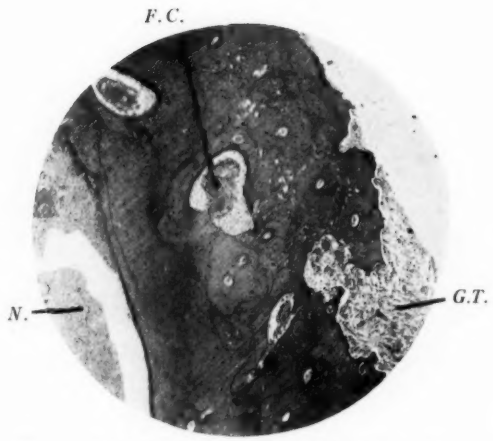

Fig. 21. Implantation of a boiled infected piece of bone into the muscles of a young cat. After 6 days we find dead, sharply defined bone with fibrin, *F. C.*, growing into the marrow spaces, *N.*, with young granulation tissue, *G. T.*, on the outer surface but with no development of this tissue into osteoblasts; and no bone-building processes.

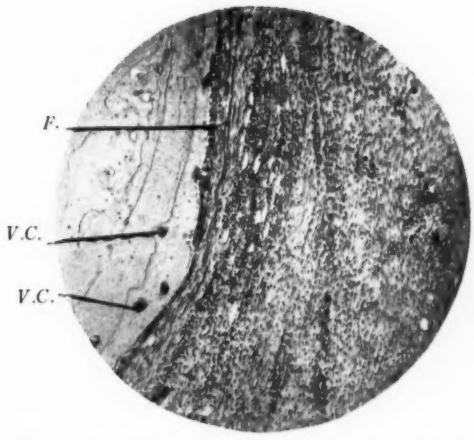

Fig. 22. Implantation of boiled, sterile piece of bone into the muscles of the back of a young rabbit. After 9 days we see dead, sharply outlined bone with, *V. C.*, new vascular canals, near the periphery and there is a thick covering of fibroblasts, *F.*, but no new bone-building processes. There is a capsule-like formation around the bone.

Compact bone, which had its periosteal covering as well as the marrow and endosteum removed, was covered on all sides by a non-specific tissue coming from connective tissue of the vicinity and as a result of its absorbing influence the bone becomes porotic. Before regeneration can set in from the edges of the remaining periosteum, marrow, and endosteum, the non-specific connective tissue of the vicinity has attached itself everywhere and stands in the way of every progressive regenerative process of the specific bone building parts.

These processes were previously demonstrated by a series of experiments (Figs. 12, 14, 17 and 18). We wish to elaborate them through illustrations from our experiment in which, in a young rabbit, a cylinder of periosteum, compact bone, and marrow and endosteum, 1 centimeter long, was removed from the upper third of the ulna, and centrally and peripherally a shell of compact bone freed of periosteum, marrow and endosteum, was formed. At the end of the operation a fracture of the half shell of peripheral fragment developed, just within the part covered by periosteum. Suture. A plaster-of-Paris splint was applied and worn 4 weeks. Figure 19 shows the condition immediately after operation, and after 8 days and after 1 month. After 8 days there are no changes. After 1 month the central fragment is united with the radius by means of a callous mass. There is a well developed callous mass at the distal fragment, which unites the broken off piece with the stump. Histologically (Fig. 20) we can see how the outer surfaces of the compact bone are walled in and everywhere eroded by the non-specific connective tissue. The same is true with reference to the bone freed from marrow and endosteum; one can see how the non-specific connective tissue of the vicinity has grown into the marrow canal. At the peripheral fragment (complete removal of the marrow and endosteum), the whole marrow canal is filled by the connective tissue of the vicinity, while the central fragment (marrow and endosteum retained) shows in contradistinction a small amount of callous formation deep in the marrow canal, in advance of the connective tissue of the vicinity which has grown in.

On the other hand we could confirm that wherever the periosteum or marrow and endosteum were well nourished and retained, and where the fracture hyperæmia could develop, unhindered bone building results through the specific bone building activities of the osteoblasts. In such cases small blood or lymph exudates could not hinder the specific bone-building regeneration. However, the blood and lymph exudate do not offer the best conditions for bone building, and the best regeneration sets in where no extravasation of blood is present. Extravasation of blood always is a damaging influence when the bone-building tissues have been disturbed or their source of nourishment interfered with. At

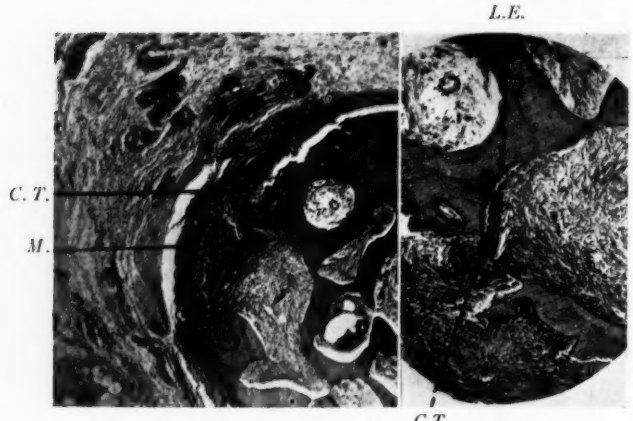

Fig. 23. Fig. 24.

Fig. 23. Implantation of a boiled piece of bone into the abdominal muscles and fascia of a young dog. After 32 days we see dead, sharply outlined bone, surrounded by a network of fibrous connective tissue, *C. T.*, which wanders into the peripheral marrow spaces, *M.* There is no change into osteoblasts and no bone building processes.

Fig. 24. Higher magnification of section from Figure 23, showing lacunar erosion, *L. E.*, of the dead bone by the connective tissue, *C. T.*, of the host.

these places the extravasation of blood is very early replaced by the non-specific connective tissue of the vicinity and forms scar tissue which is an insurmountable difficulty for beginning bone regeneration which sets in late. These views of Lexer are confirmed in our animal experiments.

Furthermore it develops that under the influence of undesired mechanical stimuli, the tissue of the non-specific connective tissue of the vicinity predominates. These facts, in connection with similar facts regarding the periosteum, marrow and endosteum, as explained previously, cause us to see in our animal experiments a further proof for the views of Lexer that the first weeks are very important, for fracture hyperæmia and bone regeneration and mechanical stimuli should be eliminated as much as possible.

At the same time important conclusions can be drawn from our regeneration experiments with reference to the question of metaplasia, which will be considered more fully in the following section. The *connective tissue elements of the periosteum, the marrow and endosteum, as well as the non-specific connective tissue of the vicinity never develop through metaplasia into bone.* Not once in these experiments in which the connective-tissue-like granulations of the marrow and endosteum seemed to meet with those of the periosteum, did bone formation appear. The connective tissue through metaplasia takes no part in bone regeneration. Bone is formed more readily when the specific bone building cells (osteoblasts) undamaged and in normal relationship with their blood vessels are present. These last findings, in a certain measure, form a basis for the following section.

II. POSSIBILITIES FOR BONE REGENERATION FROM METAPLASIA OF THE CONNECTIVE TISSUE[1]

In the first part of our paper we have endeavored to show that the metaplasia of the connective tissue into bone has very little to do with regeneration. As a result of our experiments we have come to the conclusion that under certain conditions (damage to the osteoblastic tissue or its circulation), scar tissue develops out of the pre-osteoblastic tissue of the periosteum, or marrow and endosteum.

[1]These experiments were performed by means of help from the Rockefeller foundation.

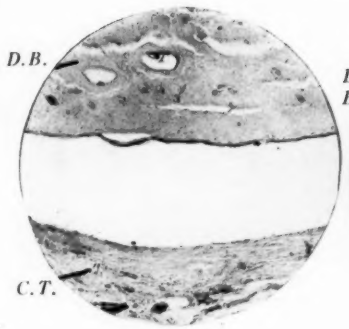

Fig. 25.

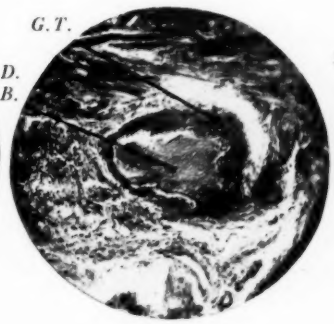

Fig. 26.

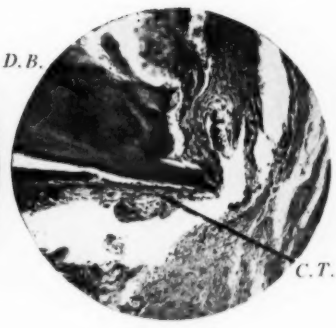

Fig. 27.

Fig. 25. Implantation of a boiled, sterile piece of bone into the musculature of the back of a rabbit. After 3 months we find dead sharply outlined bone, *D. B.*, permeated by fracture lines. The connective-tissue capsule, *C. T.*, shows no change into osteoblasts and no bone-building process is evident.

Fig. 26. Implantation of piece of bone kept sterile for 14 days without infection, into the adductors of the thigh in a young rabbit. After 14 days we find dead bone with empty spaces, *D. B.*; concentrically arranged granulation tissue, *G. T.*, of the host, without evidence of any change into osteoblasts and no bone-building processes.

Fig. 27. Implantation of a piece of bone, which was kept cold and sterile for 14 days without infection, into the abdominal musculature of a young rabbit. After 2 months, we find dead bone, *D. B.*, surrounded by a capsule of connective tissue of the host, rich in cells, *C. T.*, with no change into osteoblasts and no bone-building processes.

and therefore a pseudarthrosis results. If these traumas are not present, out of this same tissue, cartilage, osseous and bony tissues are developed as a regeneration. On the other hand, we have come to the conclusion that in bone regeneration metaplastic bone building by the connective tissue does not take place. From the practical standpoint there are different viewpoints; while most authors, as a result of clinical and experimental experience with bone transplantation, use living bone with retained periosteum, marrow and endosteum, because in this way alone, on account of its osteoblasts, it heals in and forms a living substitute, there were earlier investigators and some today who used dead or inorganic material. They argue that to a certain extent, through metaplasia of non-specific connective tissue of the vicinity a bony substitute of the dead may be obtained to serve as a beginning. Marchand, Barth, and Lexer were the first to use dead bone and bone ash, experimentally and clinically, in transplantation and treating fractures. Marchand went a step further, and used the different elements of the bone which were synthetically prepared. The use of such synthetic preparations of the elements of the bone has been experimentally and clinically investigated recently by Cotton. Marchand and other older investigators limited themselves, for the most part, to the use of calcium carbonate and calcium phosphate. Cotton uses, in addition, urine salts, or their chemical equivalents, and also magnesium and its salts in transplantation and in the treatment of fractures (delayed union of fractures). The injection of insoluble calcium salt, according to Cotton, offers the best outlook, while the practical worth of magnesium and its salts is limited, for, because of the changing of the magnesium in the tissue, hydrogen is liberated, which damages the tissue. Cotton has successfully used the synthetic preparations he advocates.

All these materials—living, dead bone, elements of bony tissue, synthetically prepared salts of bone—are used in bone formation through the activity of the osteoblasts. As several authors maintain, these materials should at the same time stimulate the non-specific connective tissue by a metaplasia into bony tissue. Advocates of the metaplasia theory with reference to bone formation are: Ollier, Orth, Gruber, Baschkerzew, Petrow, Nemilow, Nageotte, Régard, Bancroft, Weidenreich, Simon, Ferrarini, and others. Under no consideration can absolute proof for such statements be taken from cases in human

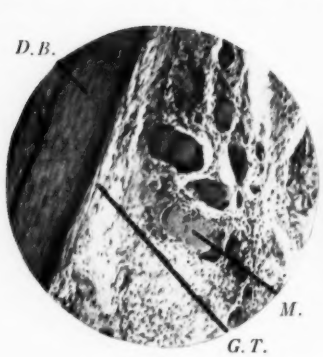

Fig. 28.

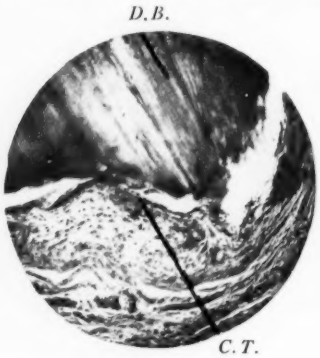

Fig. 29.

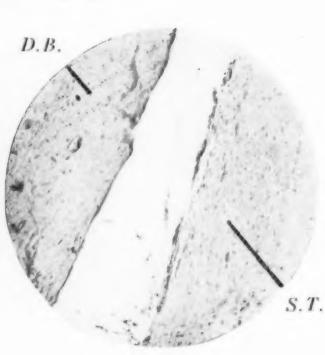

Fig. 30.

Fig. 28. Implantation of a piece of bone, which was allowed to autolyze for 14 days without infection into the flexor muscles of the upper arm, in a young rabbit. After 14 days, we find dead bone, *D. B.*, surrounded by granulation tissue, *G. T.*, of the host, rich in cells with no change into osteoblasts and no bone-building processes. *M.*, Remnant of muscle.

Fig. 29. Implantation of a piece of bone autolyzed 14 days without infection, into the muscles of the lower leg of a young rabbit. After 1 month we find *D. B.*, dead bone, surrounded by fibrous connective tissue, *C. T.*, of the host, in concentric arrangement, without the development of osteoblasts and without bone processes.

Fig. 30. Implantation of a piece of bone autolyzed 14 days, into the temporal muscles of a young rabbit. After 5 months, we find dead bone, *D. B.*, separated from the capsular tissue, *S. T.*, of the surrounding tissue. There is no development of osteoblasts and no building processes present.

pathology, as Gruber has done, because in such cases (myositis ossificans, parosteal callous formation) the beginning of the bone building from the periosteal covering of the neighboring bone has never been with certainty excluded. In the same way transplantation experiments of macroscopic pieces of living bone freed from periosteum, marrow and endosteum, into the soft parts such as Baschkerzew, Nemilow, and Petrow performed, can never give conclusive evidence that bone formation in such experiments is due to a metaplastic function of surrounding connective tissue, because on such implants there are attached everywhere living osteoblasts (Wehner, Rohde). Metaplastic bone formation from the connective tissue of the vicinity is less open to suspicion in experiments in which the bone to be transplanted is killed before transplantation. An additional necessary condition is that the bone transplanted into soft tissue should be separated by a sufficient thickness of undamaged tissue from any osteoblastic tissue of living bone or cartilage.

Of all the investigators who transplanted bone ash, especially burned bones, into the soft parts (Barth, Morpurgo Martin, Pockhammer, Basckkerziew, and Petrow) Barth alone found, in one of his experiments after putting bone ash intraperitoneally in a cat, bone formation in the peritoneal cavity. After transplanting boiled bone into soft tissue Sultan, Axhausen, Basckkerziew and Petrow, Régard and Haas never found bone formation. The negative result of their experiments led Basckkerziew and Petrow to believe that the dead bone, in addition to the loss of power of regeneration by the different bony tissues, had lost the property to incite an osteoblastic stimulus upon the connective tissue of the vicinity. Polettini and Christophe on the contrary are of the opinion that substances are present in bone before fixation in alcohol and boiling which can incite the connective tissue to form bone through metaplasia.

With these necessary prerequisites for experiments of this kind in mind (see previous explanation), we performed experiments to see if bone formation could take place from connective tissue of the soft parts through a metaplasia in the vicinity of a piece of dead bone transplanted into the soft parts. Keeping these prerequisites in mind, especially the fact that connective tissue in the vicinity of bone in the presence of severe damage to

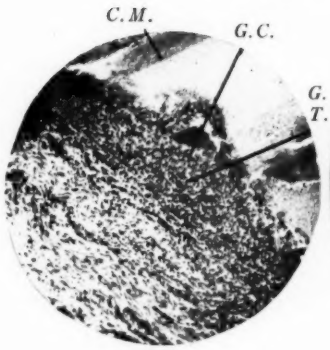

Fig. 31.

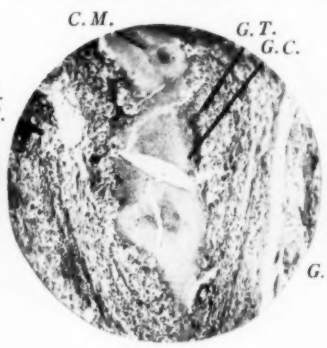

Fig. 32.

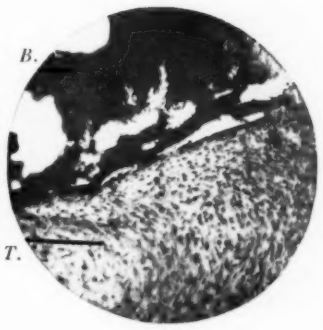

Fig. 33.

Fig. 31. Implantation of calcified mass kept cool and sterile for 14 days, without infection, into the back muscles of a young rabbit. After 14 days we find amorphous calcified masses, *C. M.*, surrounded by granulation tissue, *G. T.*, of the surrounding tissue rich in cells, with giant cells, *G. C. G. T.* Concentric fibers in the external strata of the granulation tissue.

Fig. 32. Implantation of small calcified mass kept cool and sterile for 14 days with infection into the back muscles of a young rabbit. After 2 months, we find an amorphous calcified mass, *C. M.*, surrounded by granulation tissue, *G. T.*, surrounding tissue and erosion processes through giant cells, *G. C.* There is no change into osteoblasts and no bone-building processes.

Fig. 33. Implantation of burned bone into the back muscles, with infection, of a young rabbit. After 1 month, we find, burned bone, *B.*, with granulation tissue, *G. T.*, of surrounding tissue, surrounding it, rich in cells, with fibrillary formation. There is no change into osteoblasts and no bone building processes.

muscle tissue or infection, takes part in bone formation, our experiments on animals were so conducted. The implantation area (back muscles, abdominal muscles, chest muscles, upper arm muscles, muscles of the calf of the leg, temporal muscles, tendons, abdominal fascia, subcutaneous tissue) into which the dead bone was to be transplanted, was more or less damaged through tearing and crushing so that necrosis of the muscle resulted. In another series of experiments the area of implantation was infected at the same time, in that the dead piece of bone was contaminated by the skin of the animal. For implantation, a piece of diaphysis 1 centimeter long was taken from the ulna or radius, or a piece from a rib, and killed in different ways. In the first series of experiments, the pieces of bone were boiled 10 minutes, then allowed to cool, and implanted into the soft tissue of the same animal after they had been infected by the skin. Because boiling of the bone is a coarse and unnatural killing of the bone, in a second and third series in which the bone to be transplanted, according to our view, should have no living cells transplanted with it, we kept this bone outside of the body 14 days after its removal. In this time the ability of the cellular elements to live and to proliferate is lost; bone formation as a result is with certainty excluded. The implantation material (bone with periosteum marrow and attached pieces of muscle) was removed sterile, and either kept 14 days sterile outside of the animal body in a reagent glass, excluding the air and without adding any fluid or other material, in its own tissue juices at a temperature of 6 degrees Celsius, (series of experiments No. 2), or under similar conditions in an incubator at 37 degrees Celsius allowing autolysis, (series of experiments No. 3). The material prepared in this way, at the close of its preparation, was tested bacteriologically, and only the bones found to be sterile were implanted in the soft tissues of the animals from whom these implants were taken 14 days before.

In the sterile cold preparations, there were no gross changes outside of the loss of life of the cells. In the preparation where autolysis had taken place (keeping temperature at 37 degrees) there was a process similar to catabolism in the tissues. The products of destruction, which formed during the time the tissue was kept outside the body in both cases, were present in a small amount of serum, and

Fig. 34. Formation of bone in the abdomen of a man, 33 years old, 22 days after a gastro-enterostomy for duodenal stenosis, inside of thick fibrous connective tissue, *C. T.*, of the abdominal fascia.

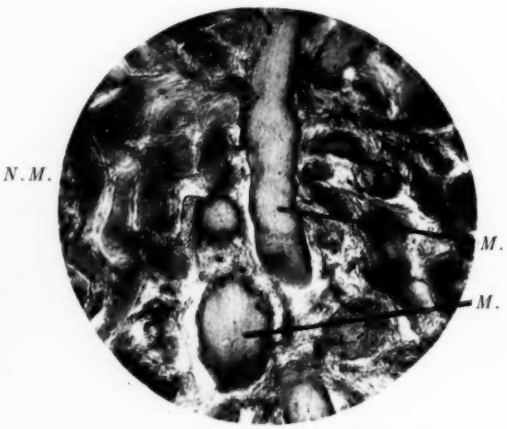

Fig. 35. Calcified muscle fibers, *M.*, in abdominal wall scar, woman 42 years old, 22 months after appendectomy. No change into osteoblasts and no bone-building processes are present. *N. M.*, Normal muscle fibers.

were in every case taken into account by transplanting this serum with the bone.

This catabolic substance must be considered and its rôle determined in estimating the metaplastic bone building power of the connective tissue, as these sera are the carriers of the reactive and reparative processes in all healing and inflammatory processes.

Furthermore on the advice of Herr Geheimrat Aschoff, director of the pathological institute of the University, who examined our preparations and substantiated our findings, transplantation experiments with masses of tissue were begun. As is well known on metaplastic grounds these lead to heterotopic bone formation. As suitable experimental material, the caseous chalky masses of calcified tuberculous glands from the hilum of a human corpse were taken out sterile at postmortem, and kept for 14 days at 6 degrees in a reagent glass with the air excluded. At the end of this period, the material was tested for sterility, and that found sterile was implanted into the soft tissues of the animals. In these experiments no great gross changes took place during the time the material was kept outside the body, except the destruction of life in a few cells.

While in these experiments organic and inorganic parts of bone were transplanted, in a fifth series of experiments only the inorganic constituents were transplanted (burned bones of the same animal). We did not transplant synthetically prepared inorganic or organic elements of the bone or decalcified bone. Because in our experiments we never found that bone developed in either autogenous bone, bony elements or other masses developed in the living body which have a tendency to metaplastic bone formation, so bone development is not to be expected from synthetically prepared bone or decalcified dead bone.

After this material, which is prepared beforehand in one way or another, is implanted into the heavily traumatized and damaged muscles, fascia, tendons or subcutaneous tissue, the soft parts were sutured together over the implantation. At different intervals the material, including the surrounding soft parts, was removed and studied.

As experimental animals we took rabbits, cats, and dogs so that we might have several species of animals and thus obtain unbiased results. Rabbits, as other investigators have established, are especially suited for bone experimentation, and there appears very quickly in the damaged muscle dystrophic calcification of the muscle bundles which spreads rapidly. With this there appears a condition, which in the pathology of heterotopic bone

formation very often precedes the real bone formation, and in many cases helps to begin bone formation. In our rabbit experiments we have, as a result of the spontaneous appearing calcification of muscle bundles, extraordinarily favorable conditions, which imitates in a surprising way the natural bone formation of many cases of heterotopic bone formation.

If in any way a metaplastic bone formation takes place experimentally in the connective tissue of the muscles, of the fascia, of the tendons, or of the subcutaneous tissue, it must develop in those experiments which nearly approach the normal development. Because the activity of the osteoblast is less in older animals, we have used only young growing animals.

The results of our experiments will be given before we go further into the discussion. Under the conditions set down for our series of experiments, there is no metaplastic bone formation within an observation period of 5 months, by the connective tissue of the muscles, of the fascia, of the tendons, or of the subcutaneous tissue when dead pieces of bone of the same animal, or a spontaneous developed dystrophic chalk mass are used. In the second and third series of experiments the material kept outside of the body with the extruded serum and its catabolic substances has produced no bone forming processes in the area in which they were implanted. At the end of our observation time (5 months) the cellular tissue of the host has completely disappeared. In a tough, wide, connective-tissue covering, the bone is encapsulated like a foreign body, without attaining a more intimate union with the tissue of the host. The tissue of the host grows around and through it, just as in porous foreign bodies (sponge or coal). From the third month on, just as the histological studies show, the process of healing-in is to be regarded as finished. By this time the dead transplant, to a certain extent, has been separated from the general body tissues by a tough wide tissue poor in nuclei (Figs. 25 and 30). It is certain that observing for a longer time would show no change in the metaplastic ability of the connective tissue to form bone, because from the third month on, we have to do with a closed process, and with a transplant completely encapsulated by scar tissue not able to react. Under the conditions set down for our experiments, we can conclude that there is no bone formation from the nonspecific connective tissue. Not once does the attempt at imitation of the stimulus, traumatic or infective, given so often as the cause of growth in the pathogenesis of connective-tissue formation in muscle, result in bone formation. Indeed, the spontaneous appearance of calcification of muscle in degenerated muscle bundles in the rabbit does not give the slightest ground for believing that bone-building processes take place but disappear again after several weeks through resorption.

The microscopic picture of boiled bones (Fig. 21 and 25) in all stages shows a remarkably sharp-edged contour of bone, bound to the surrounding tissue by a sharp, somewhat spread out border, without any sign of gradual transition from one to the other. The union of the surrounding tissue with the bone takes place very slowly; first, through the deposition of fibrin from the surrounding tissue (Fig. 21) and then by replacement of the fibrin by round cells and fibroblasts (Fig. 22), and this union from beginning to end (loose scar tissue) remains extraordinarily loose. Furthermore, it is characteristic that the granulation tissue grows very slowly into the extraordinarily long retained marrow necrosis areas found in the marrow spaces and canals. Slowly are these replaced by granulation tissue and remain to the last as necroses of the marrow. At the same time it is worth mentioning that the bone cells stain well and that their dissolution is gradual. With reference to the marrow cylinder with its well retained ability to take up stain, as well as to the bone cells, the microscopic study shows with definiteness that these are dead protoplasma masses and through cooking presents a fixed picture—irregular pointed contours of the cells and nuclei, shrunken and deep, dark stained nuclei.

The fixed cylinders of necrosis lying in the marrow canals, and also the bone cells, have shrunken together toward the center of the canal, and in this way have lost contact with the bony wall (Fig. 21). The vessels and cell

masses of the fixed necrotic cylinder of marrow lie in a light rose colored homogenous mass in a hæmatoxylin eosin preparation (Fig. 21). These fixed cell masses even in the oldest preparations never show any evidence of life. As previously explained, they are gradually resorbed by the granulation tissue of the host, which creeps in. Even the fixed bone cells never show any division of the nuclei; the dissolution of the nuclei takes place slowly. These conditions depend upon the fact that through boiling, a protoplasmic substance (fibrin) develops, in which the dead cells are fixed and included. As corks, these masses stop up the marrow spaces and bony canals, and make difficult the creeping in of the granulation tissue and retard the splitting up and dissolution of the included cells and cell nuclei. This is the reason for the slow appearance and incomplete union remaining between bone and host. For the same reason, the resorption of bone is small and is evidenced only in the form of small lacunar erosions (Fig. 24). The giant cells which, together with the other cells of the granulation tissue, take part in the erosion, are smaller than osteoclasts and seem identical in figure and form with the usual foreign body giant cells. In those late cases, in which the bone is encapsulated as a dead porous foreign body and scarcely permeated by the tissue of the host, the bone is very brittle and on sectioning with the microtome falls apart into its lamellar system (Fig. 25).

Several findings which are important in the question of metaplasia and could lead to an incorrect diagnosis must be explained. In the first weeks, especially in those cases not disturbed by infection, the granulation tissue pressing toward the bone, attaches itself to the bone with its fibroblasts and forms a cellular layer lying on the bone (Fig. 21). Under the stimulation of the bone there develops here, as Figure 22 shows, an active nuclear division of the fibroblasts, so that the nuclear content of the tissue on the outer surface of the bone is greater than at a greater distance from the bone. By superficial study of these fibroblasts standing close together on the outer surface of the bone, we might consider the connective tissue cells as changed into osteoblasts, especially in those places where these masses, rich in cells, on the outer layer of bone sink into openings of the haversian canals (Fig. 22). However, after careful study, there is not the slightest evidence to show that they are osteoblasts. These cells always retain their small, spindle form figures; their small spindle-like and dark nuclei, never take the vesicular form (also larger) of the osteoblasts with their large, round, and slightly colored nuclei. They lie perpendicular at first (Fig. 21) and from the eighth day on, parallel to the outer surface of the bone (Fig. 22) and never lose their fibrillary structure (formation of delicate connective tissue fibers). Nowhere does a metamorphosis of the cells develop. From the fifth week on the multiplicity of cells, which comprise the fibroblastic layer clinging to the bone, disappear, (Figs. 23 and 24,) so that immediately on the bone there is a fibrillary connective tissue which becomes poorer and poorer in cells, and finally the bone is covered by a dense scar tissue (Fig. 25).

In preparations up to 3 weeks, there are seen the homogenous masses, previously described, between the dense fibroblastic layer on the outer surface of the bone, which is the hæmatoxylin eosin preparation. These masses are colored light rose color (Fig. 21). With a longer period of observation these masses are more and more replaced by the fibroblasts (Fig. 22). These same homogenous masses, as previously explained, are also found in the marrow spaces and bony canals (Fig. 21). They present toward the center of the canal shrunken fibrin, cell and blood masses of the marrow and its capillaries. By superficial examination, it is possible to regard these as young osteoid cells. Careful investigation, especially the presence of fibrin shown by staining after Weigert and Kockel, show these masses to be simply fibrin, while the cells are either living fibroblasts of the host, or else are shrunken dead cells of the marrow. In these preparations there is the usual fibrinous deposition from the host, or fibrinous masses which, on account of boiling of the transplant, have fallen out of the marrow. These deposits of fibrin are rapidly replaced on the outer surface of the transplant, inside the bone later, and then only slowly by the tissue of the host. The preparations under consideration are the

same as one sees in the healing-in of foreign bodies, especially when it concerns porous bodies, as long as the healing-in process is associated with marked exudative processes and marked reaction of the tissues of the host.

We have already mentioned, that, in the other series of experiments bone formation never occurred, but that the *implants* of these experimental series are encased by the tissues of the host as foreign bodies by firm masses of connecting tissue (Fig. 30). The processes of healing-in take place, for the most part, as in the case of the boiled bones. A detailed description need not therefore be given; the reader is referred to the explanations given above. On the other hand, the differences which came to light in the various experimental series, with regard to the processes of healing-in, must be more exactly indicated.

The boiled bone fragments still display, up to the third month, quite extensive preservation of their nuclear staining (shriveled bone corpuscles and medullary cells) which result from a fixation caused by the boiling. In contrast to this, control experiments before implantation of the bone fragments which are preserved cool, show that the various cell-varieties of the bone have lost nothing in their form and capacity for staining through preservation, with the exception of the periosteal covering and the immediately adjoining bone corpuscles. Somewhat greater changes appear in the bones subjected to autolysis, in that the staining power of the cell nuclei has somewhat diminished, and in the marginal portions of the bone in greater measure than in the case of the pieces which have been preserved cool, empty bone spaces or bone spaces with pale nuclear shadows occur. In both cases (bone preserved cool and autolyzed) the attached muscle fibers are swollen, without nuclei, the fatty tissues dull, the erythrocytes pale. Thus, in neither case, has any decomposition of the dying cell and nuclear masses of the actual bone tissue taken place. This rests upon the fact that the tissue fluidity necessary to decomposition is almost lacking.

If now the bone fragments are replanted in the living bodies of animals, changes very quickly set in. In bones which have been preserved cold, we find the bone spaces, after a fortnight passed in the living body of an animal, completely empty, while in autolyzed bones they are still partly filled, after the same length of time has elapsed as in the cool preserved bones, with nuclear shadows, which, in individual cases, persist up to the fifth month as scarcely recognizable shadows in small splinters of compact bone. In both cases (bone preserved cool, and autolyzed) the periosteal tissue and endosteal tissue have completely disappeared after 14 days, while the marrow tissue is still well preserved, in so far as its structure is concerned, but greatly bleached in so far as is concerned its color. To the last, necrotic fat remnants of the marrow and the surrounding soft portions persist, as they plainly present greater difficulties to the surrounding tissue in their assimilation as a result of some sort of coagulation processes or decomposition products. The surprisingly quick destruction of the nuclei, which were still well preserved before the implantation, is a result of the contact with the tissue fluid, which in the living body continuously flows about and through the implantation and thereby makes possible the breaking down of the cells and nuclei.

As to the reaction of the surrounding tissue, we have mentioned the fact that, in the case of the boiled bone fragments, the invasion of host tissue takes place only slowly and in small measure; exactly the same thing is true in the case of the transplantation experiments with calcified masses (Figs. 31 and 32). In contrast to this the autolyzed bones (Figs. 28 and 30), and especially with the bones which have been preserved cool (Figs. 26 and 27) a very swift and very abundant penetration by the tissue of the host takes place. This is due to the fact that the boiled bone fragments from the beginning resist the opportune access of the tissue fluid as a result of the closing of the bone spaces and small canals by coagulation products (the result of boiling); and for the same reason, because of the obstruction of the little canals, the cellular elements of the host can press forward into the boiled bone fragment only with difficulty. Thus they offer greater resistance to the host, and for that reason the encapsulating processes resulting from their influence as foreign

bodies naturally manifest themselves in these cases in the form of early appearing bundles of connective tissue. The poor breaking down of the necrotic nuclei of the boiled bone fragments is related to the same processes.

In the cool preserved and autolyzed bones, no similar closing of the marrow spaces by coagulation products takes place. Consequently, they are more quickly penetrated by the tissue fluid and the cellular elements of the host, with the result that there is a more highly developed relation between *the transplant* and the host. Upon similar grounds, the absorption processes in the case of the cool preserved and autolyzed bone fragments are more strongly marked and are accompanied by a richer development of the giant cells. But in any case, with all transplants, the absorption processes remain unimportant and are soon exhausted, so that at the close of the period of observation, in all cases, a bone only slightly eroded lies encased within a firm mass of connecting tissue poor in nuclei.

In the case of calcified masses (Figs. 31 and 32) there are more pronounced encapsulating processes, in the form of fibrous formations, than with the bone fragments which have been preserved cool or autolyzed. An invasion of cells from the host does not take place. The calcified masses are not decomposed, but only on their periphery attacked to a limited extent by giant cells forming small lacunar erosions (Fig. 31 and 32) and encased as foreign bodies.

The porous carbon masses of charred bones (Fig. 33) permit a swift penetration of their hollow spaces on the part of the tissue fluid and the cell masses of the host. However, no inner union with the host takes place here either, only a slight definite erosion of the bone, early and marked encasing-processes (formation of fibrils), and finally the imbedding, in a firm fibrous mass.

While the absorption processes in the bone in all the various series of experiments occur only to a limited extent, and appear as small lacunar erosions, there are, nevertheless, differences in the absorption processes, depending upon whether we are dealing with large, small, or very small bone fragments. The cellular reaction, especially the number of giant cells, is notably greater around small splinters (Figs. 26 and 32) or the points of jagged pieces (Fig. 27), penetrating far into the tissue; it continues longer, and results in stronger erosion processes in the implants than around large, especially compact, pieces and in the case of the surfaces of smooth bone fragments (Figs. 28, 29, 31 and 33). Furthermore, the formation of excluding bundles of connecting tissue sets in later around the small splinters or the penetrating points of bone than around large pieces of bone and flat surfaces.

Thus we arrive at the law, that the smaller the implant, or the more irregular its surface, the stronger are the cellular reaction and absorption processes, and the longer do they continue. This has its cause partly in the fact that small splinters, or jagged bone-points, produce in the host a stronger traumatic irritation than the smoother surfaces of larger pieces of bone. In the main, however, the difference may be ascribed to the fact that small bone fragments, or jagged bone-points, have a relatively greater surface than large smooth pieces, and that therefore, corresponding to the greater surface extent of the former, the resorption processes are stronger here than in the case of the large, smooth implants with their relatively small surface. However, the possibility remains that small bone-splinters can be resorbed by non-specific connective tissue; in larger bone-fragments, however, the resorptive power of the connective tissue fails because of the mass (involved). In these cases the connective tissue accomplishes only an encasing (of the bone) as a foreign body. The situation here is exactly the same as in the transplanting of living bones into the soft parts, when the osteoblasts of the latter have been destroyed by hæmorrhage or infection. If the surrounding granulation tissue is still young, it acts resorptively on the bones, as is well known. If, however, in such cases, the bed has once been transformed into a capsule, the remnants of bone remain intact within this scar tissue. The situation is similar with the healing-in of dead transplants, especially in heteroplastic work and in the use of fresh bones from cadavers, in which cases the healing-in of the dead substances proceeds with-

out a trace of the atrophic stage which otherwise sets in, but with firm encapsulation.[1]

In order to understand the reasons why, in our experiments, metaplastic bone-formation on the part of the ordinary mature connective tissue of the soft parts did not take place, and further, whence and how the heterotopic ossification of the soft parts comes into existence, more extended explanations are necessary. We know that, in the course of the atrophy and decay of tissues, they act upon the surrounding tissues and set in operation the whole series of resorptive and regenerative processes. At the same time they maintain the hyperæmia, caused by trauma or infection, which is the primary condition of all reparative and regenerative processes. Regeneration is thus immediately dependent upon the products of tissue decomposition. These products of tissue decomposition exercise in the tissue two kinds of activities: specific and non-specific. When they come in contact with living cells of their own kind, they stimulate them to the creation of cells specific for that tissue and cell products, or furnish them indirectly, through hyperæmia, with an increased supply of nutrient materials. On the other hand, the decomposition products at the same time stimulate the living tissue of different cellular composition also to the creation of cells and cell products of its own variety. Both processes take place side by side. Healing of defects of whatever kind depends upon the question whether, at the place where the tissues have been injured, tissues of the same structure are present in sufficient quantity, whether these possess sufficient vitality, whether their vitality and capacity for regeneration has not previously suffered through obstruction of the channels of supply, or whether, on the other side, the tissue of like cell structure has been injured or destroyed by the effects of trauma or infection, or through obstruction of the channels of supply.

In one instance regeneration takes place out of tissue and tissue products of like cell structure; in the other, only a defective substitute, produced by tissue of different cell structure results, in which case the non-specialized connective tissue, abundantly present in the body, provides for the substitute and leads to the formation of a cicatri.[2]

Now these products of tissue decomposition are of especial importance for our investigation. In dealing with the question of metaplasia, chemotrophic and other irritating influences are still considered, which are supposed to come from the living bone in process of decay and act upon the tissue of the host, stimulating it to metaplasia and bone formation. Irritating influences are present, their media are either trauma or infection, but chiefly the decomposition products of decaying tissue. In the second and third series of experiments, in order to test their capacities, we transplanted the decomposition products which had separated out in the test tube, along with the bones. For the rest, in all the experiment series the decomposition products liberated in connection with the healing-in of the living body through the breaking down of the transplants take part in the process. The question now arises, upon what tissues these products of tissue decomposition act. Since Baschkirzew and Petrow deal with bone fragments transplanted living, the decomposition products affect in the first place the living osteoblasts of the bone which are transplanted living along with it: they stimulate them to regeneration; thus bone formation arises from these osteoblasts. On these grounds, as we have already mentioned, bone fragments transplanted living in soft parts cannot be cited in proof of the capacity for metaplasia of the connective tissue in bones. Moreover, we know, in the pathology of pathological decomposition processes of the most varied sorts, from living bones there is no ossification in the neighboring soft tissues. Unfortunately, bones experimentally transplanted alive into the living bodies of animals cannot be brought, as is desirable, to a gradual mortification and decomposition in such a way as to eliminate the bone forming capacities of its osteoblasts. However, one may mention those cases from human pathology, also sup-

[1]Lexer. Die freien Transplantationen. vol. ii, Knochentransplantation. Stuttgart: Enke, 1924.

[2]Compare Knochenregeneration oder knoecherne Heilung von Frakturen on one side; Pseudoarthrosen, on the other side, Lexter Arch. f. klin. Chir., vol. cxix, and Rohde, Arch. f. klin. Chir., vol. cxxiii, and part I of this article.

purative bone transplantations in soft parts in animals, in which, in living bodies, around bone fragments slowly dying on account of infection, no sort of bone formation takes place in the surrounding soft tissues, but in which the dead bones are occasionally removed from a granulation cavity by later operations or are spontaneously ejected. We have made histological examinations of such bones and the flesh in which they were embedded, in a whole group of such cases, and have never found bone formations.

If the capacity of osteoblasts of the transplants for life and regeneration are eliminated through appropriate experimental arrangements, the decomposition products of the bone tissues may act only on the cells of the host. In our experiments, a bed was chosen which had no osteoblasts; thus regenerative processes caused by the latter did not take place. Only such processes were possible as led to the formation of tissues which were present and vital on the spot. Otherwise, the connective-tissue cells would have to be led back by the decomposition products and the tissue reaction sustained by them, to an indifferent stage which would enable them to form also other derivatives of the connective-tissue series, such as *Knochen vorstufen and bones*. We take the standpoint of the anatomists, that Dollo's law of the non-reversibility of a development process once under way holds good for histology also. Cells which, in the course of their growth, have developed out of mesenchyme cells into ordinary connective-tissue cells, and have thus been so transformed that, according to the anatomist, Maurer, they may be designated only as remnants of the original primitive cells, cannot again become differentiated so that they may revert to indifferent mesenchyme cells and from these develop into osteoblasts. In this process there disappears also the possibility of bone formation out of ordinary connective-tissue cells. The implants and their constituent parts and decomposition products influence only the locally stationed cells to reactive processes under the influence of hyperæmia, which in all experiments appears clearly in the first week. Thus there arises out of the connective tissue a granulation tissue with connective-tissue cells which at first are round and vesicular, later become spindle-shaped, and which, consistently with their origin, can develop only into a mass of connective tissue, but never into Knochen vorstufen or bones. Our experiments show that very clearly.

From clinical observations as well as from our experiments, we come to very definite conclusions, namely, that metaplastic bone formation does not take place from the ordinary connective tissue, and that bone formation in every instance is to be attributed to specific bone-forming cells (osteoblasts). The osteoblasts are formed either in the general development process through differentiation from the indifferent mesenchyme cells; or they are formed after the conclusion of the tissue and organ development from osteoblasts which are present (periosteum and endosteum) through regeneration processes; or they arise in a completely developed organism through differentiation of mesenchyme cells which have remained undifferentiated. From a study of anatomy and pathology (tumors) it is evident that even in a completely developed organism, youthful embryonic cells with their manifold possibilities of development and differentiation, may remain present throughout a whole lifetime, and at an appropriate time may unfold their possibilities of development. Of course, this holds good also for the layer of embryonic mesenchymal tissue. In the course of the tissue and organ development the mesenchyme develops into connective tissue, fascia, tendons, fat tissue, muscles, cartilage, bone-forming tissue, or bone. There remain here and there undifferentiated cell groups, which do not participate in the further development of the organs. These unused mesenchyme-cells (Stamm cells after Stohr-von Mollendorff) retain in themselves all their development potentialities. In later life if any kind of traumatic, infective, or toxic irritation or metabolic disturbance affects cells of this kind, they are brought out of their latent stage and are able, within the limits of their peculiar development possibilities, to differentiate themselves. Along with other derivatives of the mesenchyme series there may also occasionally arise out of such cells tissues of the bone series.

Heterotopic bone formation finds in this its explanation. As for parosteal ossifications, Lexer and others have always emphasized that not the ordinary perfect connective-tissue formation but only very special, adapted connective-tissue formation permits ossification-processes to arise. From our study we can understand this.

It is easily understood that in the immediate neighborhood of the bone structure unused mesenchyme cells remain and that under the influence of some irritation or metabolic disturbance, these occasionally unfold their slumbering osteoblastic possibilities. Thus myositis ossificans circumscripta becomes comprehensible, though it is to be observed here also, that, in a great number of such cases, the cause is the tearing of the periosteum. Myositis ossificans progressiva is likewise to be explained by bone formation from unused mesenchyme cells, which under the influence of metabolic processes, develop their bone-forming capacities; the histological proof of the transformation of such cells of the intermuscular connective tissue into cells with the properties of osteoblasts, Lexer was able to produce years ago in his studies on myositis ossificans progressiva.[1] Ossification of the Achilles tendon of many kinds of birds near the heel-bone, abdominal bone formation in the castration scars in animals, and abdominal bone formations in man; likewise penis bones in man are explained, and are at the same time atavistic reversions.

With reference to abdominal bone formation in laparotomy scars we will cite two cases of our own. In the first case, the patient was a 58-year-old man with greatly enlarged abdominal veins, in whom a carcinoma of the pylorus was resected. In the course of the after-treatment, a thrombosis of the greatly enlarged subcutaneous abdominal veins set in. Ten months after the operation, there was observed in the patient, who had made a magnificent recovery, within an insensitive scar, about four finger-breadths below the xyphoid process, a hardening about 6 centimeters long and 3 centimeters broad, which a histological examination revealed as a formation composed of bone, cartilage, and connective tissue. It lay within the connective tissue of the abdominal fascia.

The second case was a 33 year old man, who had had a gastro-enterostomy for duodenal stenosis. After 10 days, in which no fever developed, the stitches were removed; healing took place by first intention. The patient was up and about. The next day after operation or after stitches were removed a little hæmatoma drained. Twenty-two days after the operation there was removed from the wound, which healed *per secundam*, a hard formation, 2 centimeters long, and as thick as a match, which had developed within the fascia midway between the umbilicus and the xyphoid process. Upon histological examination (Fig. 34) there was found a well defined bone formation with several lamellar systems and detached marrow spaces. Besides completely formed bone there was cartilage, osteoid, and young embryonic tissue, which proceeded from the firm-connective tissue of the surrounding substance.

To both these cases of true bone formation in the abdomen in laparotomy scars we can add a third important observation. It concerns a 42-year-old woman in whom 22 months previously a chronic appendix had been removed through a pararectal incision. Primary union of the wound. Twenty-two months after the operation the patient came to the clinic on account of a painless hard mass in the operation scar which had developed slowly in the course of 3 months. At operation there was a stone hard mass in fibrous scar tissue of the abdominal muscles which was removed. Histological study (Fig. 35) shows inside the scar tissue, consisting of spread out connective-tissue bundles which have become hyalinized, some normal muscle fibers and a larger number of calcified muscle strands. In the vicinity of this calcification there is an increase in the number of cells, but no cells similar to osteoblasts and no bone building processes are present. In this case in spite of abundant calcification in the destroyed musculature there was no bone formation after 22 months.

It is known that in abdominal wounds and scars very often calcified deposits are found but no bone formation. The presence of calcium salts alone then cannot be the cause of heterotopic bone formation, otherwise in the numberless laparotomies it would occur more often. In all tissue destroyed and in hæmorrhage there is calcium deposition. If one considers how often these processes take place in different parts of the body, which have a predilection for heterotopic bone formation (elbow, upper arm, thigh, abdominal wall), and how extraordinarily seldom in these same areas bone formation in soft parts has been observed, we are astonished at the importance, and sometimes very great importance, assigned to the deposition of calcium in the tissue in the pathogenesis of bone formation in soft tissue. The calcium salts are of importance only when they come in contact with osteoblasts or remaining mesenchymal cells.

[1] Arch. klin. Chir., 1895, l, 1.

If this contact is not attained, even if the calcium salts are abundantly present, no osteogenesis takes place in the soft tissue. The rôle of calcium salts in heterotopic bone formation in the soft parts, and especially in bone pathology, is of secondary importance. *Fundamental prerequisites for bone formation* are *living osteoblasts or unused remaining mesenchyme* cells which can develop into osteoblasts. These bone-building cells, without any spontaneously developed deposit of calcium salts and without artificially brought bone-building substances can take the organic and inorganic substances from the living organisms which they need for building of bone. A measure of support to these processes through local or general diminution of organic or inorganic bone-building substances may be allowed in certain cases of disturbance of the local or general calcium metabolism. A fact to be learned in advance is that the use of such things in the organism is not connected with a damaged osteoblastic tissue, which fact Cotton pointed out in the discussion of his magnesium injections.

As a result of clinical experience and our experiments we have come to the conclusion that after excluding tissues and organs, bone building power is found only in specific bone-building tissues (osteoblasts of the periosteum and marrow endosteum). Metaplastic bone building from the usual connective tissue of the musculature, the muscle septa, the tendons, the fascia, and the subcutaneous tissue does not take place. Heterotopic bone formation in soft tissue is from the unused remaining mesenchyme cells, which, through traumatism, infection, toxic stimuli, or disturbance of metabolism, may abandon their indifferent stage at any time and commence to build bone.

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BLADDER NEOPLASMS

Brief Series from the Department of Urology, Royal Victoria Hospital

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IN considering malignant growths of the bladder we find a great diversity of opinion both as to the pathology and methods of treatment. There are many classifications of these growths, and many ways of dealing with the subject. Some authors depend entirely on the microscopical findings while others are guided mainly by the clinical picture. The great difficulty in the diagnosis by microscope is the transitional type of cell, and the manner of growth. How often in every service do we find the laboratory report "papilloma undergoing malignant change." Oertel contends that it is almost impossible to distinguish between a diffusely growing carcinoma and a sarcoma in the bladder. But the difficulties are not confined to the microscope. The clinical diagnosis has also its problems.

In 1922, Lower reviewed so thoroughly the classifications of Buerger, Geraghty, Judd and Harrington, Barringer, and the end-results of Gardner, Thomas, Scholl, and others, and also added so excellent a series of 222 cases of his own that it is unnecessary for me to go into the details of previous experience and conclusions.

The majority of primary tumors of the bladder are of course the papillary fibroadenomata, and the papillary villous cancers. Besides these, squamous celled cancers with epidermization, and cylindrical cell cancers, are at times noted. Of other tumors, fibromyomata, sometimes with other connective tissue additions, and large, sometimes papillary, nodular, sarcomatous myomata of either smooth or striated muscles occur. Much rarer are the ordinary small, round-celled sarcomata, spindle-cell sarcomata, and, very rarely, lymphosarcomata and osteosarcomata.

In the histogenetic classification of the tumors, according to the type of their parent soil, a distinction is made in the first place between epithelial and non-epithelial tumors. The latter are naturally derived from the deeper layers of the vesical wall, the muscular or the submucosa. Among the benign mature forms, myomata, leiomyomata, and fibromyomata are met with, and pure fibromata may also occur. These tumors are usually small, spherical, and easily enucleated. They acquire a greater interest when the shape of their cells, and often at the same time, also, the type of their growth, undergo a change. In this manner, large, nodular, fibrosarcomata, sarcomata, and myosarcomata, consisting of immature anaplastic cells, may originate. Pure sarcomata are rare.

The tendency of the bladder to the formation of mixed tumors is shown by such malignant tumors being often mixed with various other tissue types; genuine teratomatous mixed tumors have also been observed. There are osteoid chondrosarcomata, rhabdomyosarcomata, sometimes with cartilaginous insertions, adenofibrosarcomata and so forth. Furthermore there are angiomata, carcinomata, and lymphangic endotheliomata.

The most important group of bladder tumors are the epithelial tumors. These are derived in part from the epithelial nests or from aberrant prostatic germs, adenofibromata, and adenomata, or they are developed from the surface epithelium. These tumors are the proliferations generally known under the name of papillomata, and papillary carcinomata. In the interest of accurate nomenclature, these tumors should be designated not as papillomata but as papillary epitheliomata or fibroepitheliomata, and as papillary carcinomata, for any tumor can be papillary, including sarcoma, whereas the decisive point for the designation is the histological composition of the tumors, and this is fibro-epithelial in character.

Probably a larger number of bladder cancers than supposed are extensions from the prostate. Kaufmann states that out of 27 prostatic cancers, 18 had extended to the

bladder, and with preference to the posterior wall. This has recently been brought quite forcibly to our attention in three operative cases, and in two not operated upon. The growths in the bladder are commonly knob-shaped, nodes and plates, covered by relatively normal mucosa or with slight sloughing. They often resemble, clinically, a strawberry myoma, and have slightly the appearance of the aged canned strawberry. Some surgeons believe that many so-called primary bladder tumors are in reality prostatic cancers. The fact that a prostatic cancer may occur in a grossly not enlarged prostate makes this not improbable, even in cases in which the prostate is apparently grossly unchanged.

The epithelial tumors of the bladder are often divided into benign papillomata and malignant papillomata. Perhaps the commonest suggestive clinical signs of malignancy in these growths are:

1. Induration
2. Slough
3. Resistance to fulguration
4. Single tumor-multiplicity very often means benign tumor.
5. Age of patient—older patients are more probably malignant.

Geraghty classifies these tumors as:

- Papilloma
  - Benign
  - Malignant
- Adenoma

Tumors of epithelial origin:

- Cysts
- Carcinoma
  - Papillary
  - Squamous
  - Adenomatous

Tumors of connective tissue origin:

- Sarcoma
- Myxoma
- Fibromyoma
- Angioma

Tumors of muscular origin:

- Myoma

Heterotopic:

- Rhabdomyoma
- Hydatid cysts
- Dermoid cysts
- Chondroma

Buerger divides them still farther into:

1. Papilloma
2. Infiltrating papilloma
3. Papilloma with carcinomatous changes
4. Primary papillary carcinoma
   a. Papillary polypoid type
   b. Secondarily infiltrating type
5. Primary squamous-celled carcinoma
   a. Infiltrating type from papilloma
   b. Squamous type from papillary tumors
   c. Secondarily prostatic tumor, metastasis from without.

In the main these classifications are the same. Personally I like the general plan of Christeller, and divide these growths as follows:

1. *Typical papillary fibro-epitheliomata (benign).* Their most important sign is that the epithelial proliferations remain restricted to the mucosa, and is thus directed only toward the interior of the bladder. There is no tendency to grow into the deeper tissues, and these tumors are therefore displaceable on their base.

2. *A typical papillary fibro-epitheliomata (malignant).* These tumors, although presenting certain histological irregularities in the pigment and basement membrane, are without the most important signs of malignancy, in the form of destructive growth. They penetrate nowhere into the submucosa or muscularis, and do not give rise to metastases, often reported as benign undergoing malignant change.

3. *Papillary carcinoma.* These tumors are characterized by a destructive deep growth into the muscular layer. The superficially papillary structure closely resembling fibro-epithelium is deeply alveolar, as in all other carcinomata. The histological diagnostic examination fully reveals the existence of typical cancer cells and destructive growth in the second and third stage, so that the diagnosis of malignancy can be positively rendered, the diagnosis of benignity in these cases affording information only of the segment of the tumor examined, and not of the growth as a whole.

4. Aside from papillary cancers solid cancers also occur in the bladder, being histo-

logically in part solid cellular medullary cancers, in part scirrhous or alveolar types.

In the literature of the subject the inoperability of a large proportion of cases of bladder tumors is rightly attributed to the length of time which elapses between the first symptom and the operation. The cystoscope has made the diagnosis of the presence of bladder tumors so easy that there is absolutely no excuse for the long untreated histories which we find in those cases. The history of our own cases varied from 2 weeks to 30 years. It is not the absence of symptoms that causes havoc, but it is rather the failure to appreciate the importance of early symptoms. Blood in the urine is never physiological; it is a symptom of some pathological condition, and it demands instant investigation. An analysis of 821 hæmaturias in our clinic showed that 192 were due to calculi, 113 to tumors, 88 to renal tuberculosis, and 143 to surgical infections of the ureters and kidneys, or, excluding the urethra, 536 cases out of 761, that is 70 per cent, were caused by calculi, tuberculosis, cancer, or surgical lesions of the kidney; while the other 30 per cent most certainly required investigation. The great importance of subjecting these patients to a careful and thorough examination is at once apparent.

With the cystoscope in the bladder, unless the bleeding is profuse, the growth within the bladder can easily be detected, and the surgeon can frequently determine from the cystoscopic picture whether the tumor is benign or malignant.

The benign tumors are delicate, floating, warty growths of pale pink color, the vessels in the fronds often being visible. The different branches of the tumors float about in the irrigating fluid and the neighboring mucous membrane of the bladder looks absolutely normal.

On the other hand malignant papillary growths are often single, there may be necrosis of the masses, or they may be partially covered with exudate, the fronds are more or less united, presenting the appearance of a mixed papillary and solid growth, and the adjacent mucous membrane of the bladder is often œdematous and rugated—so called bullous œdema. Again benign tumors melt away under fulguration treatment, whereas the malignant ones are much more obstinate. Vaginal or rectal examination, which should regularly be made in all doubtful cases, often will show the increased resistance of the infiltration of a malignant growth of the base of the bladder.

There is also another cause for diversity of results in the treatment of those growths. A tumor in the vault of the bladder is an altogether different proposition from a growth surrounding the vesical neck, regardless of what type of treatment is used.

In our own small series of cases, we do not attempt to advance anything new in diagnosis or definite in treatment but we wish only to add our results to those of others.

Our list includes:

Total number of cases	288
Total benign, microscopically and clinically	110
Number microscopically malignant	85
Number clinically malignant (not microscopically confirmed)	33
Total malignant tumors	118
Males	93
Females	25

	Total	Males	Females
Papilloma, malignant, clinically	30	23	7
Papilloma, malignant, microscopically	9	8	1
Papillary carcinomata	70	60	10
Carcinomata, medullary, etc	8	5	3
Sarcoma, mixed growth	1	1	0

Age

	Youngest	Oldest
Papilloma		
Males	33	71
Females	26	62
Carcinoma		
Males	30	88
Females	23	71
Sarcoma		
Male	31	

The pulse, temperature, and respiration curve in uncomplicated cases is no aid to diagnosis, showing no constant variation.

Complaints (according to frequency and order of occurrence)

Hæmaturia. Chief complaint in 75 per cent of cases, and usually the cause for seeking relief.

Frequency. Chief complaint in 25 per cent of cases, associated in 40 to 60 per cent.

Dysuria. Chief complaint in 10 per cent of cases, associated in 15 to 20 per cent.

Associated complications. Pain in loin; incontinence; pain in perineum and genitalia. Suprapubic pain, not common.

Relief was sought by patients anywhere from 2 weeks to 30 years after appearance of

symptoms. If there was copious initial hæmaturia, aid was sought immediately. The cases, of longer duration in many instances, proved to be papillomata, which had undergone malignant changes.

In the early stages, carcinoma is a local disease. The rational treatment, theoretically, at least, is complete and radical excision. In the bladder the disease often remains local for a long period, and does not metastasize readily. Every effort, therefore, should be made to bring these patients for examination early, that we may get rid of the local involvement before it becomes a general condition.

As a great many cases occur in the sixth, seventh, and eighth decade, the history and clinical picture are often combined and associated with signs and symptoms of prostatism. As many of those cases give a history of several years, the age curve does not represent the true curve for the beginning of bladder tumors.

It would appear that the gastro-intestinal manifestations of bladder tumors, as compared with renal lesions, are comparatively few.

Some patients complained of constipation, and this was usually proved to be an anatomical effect. Symptoms of hypersecretion (gas eructations, hyperacidity, and the like) are not the rule, but it is interesting to note that in nitrogen retention, due to conditions of and within the bladder, the urea nitrogen may go to three to four times normal, while the creatinine remains stable and fixed. The gastro-intestinal symptoms in those instances are few.

Loss of weight and strength are marked only in the advanced cases, while the blood pressure findings vary greatly, being low, frequently, in the advanced carcinomata.

Physical examination of the genito-urinary tract. The ordinary examination fails to disclose little that is diagnostic. Abdominal examination may be said to be negative. Occasionally there is suprapubic tenderness, which is usually present when there is an associated acute cystitis.

Rectal examination in the case of papilloma of the bladder is practically always negative. In the case of carcinoma of the bladder, the infiltration of the wall may cause the mass to be palpable, while nodules in and about the prostate may be significant.

The urine findings are as one might expect. There is often macroscopic blood; the specific gravity usually shows good variation; the associated nephritis, as evidenced by casts, is not marked; albumin is present from a slight trace to a considerable degree. Sugar was found in only one case in the series, and this was a true glycosuria. Microscopical examination shows pus and red blood cells in varying degrees. In rare cases, pieces of tissue were passed in the urine and were of diagnostic value.

Kidney function (phthalein). The phenolsulphonephthalein estimations are usually below normal but, as in cases of the blood chemistry figures, this condition improves following the establishment of free drainage.

Sufficient blood findings are not available to be of value but in several cases of carcinoma there was a slight leucocytosis. There is usually a varying secondary anæmia.

In addition to these findings there may be the usual derangement of the various systems. In only one case was there a positive Wassermann.

Cystoscopic examinations. Findings at cystoscopic examination usually enable one to make a diagnosis. Occasionally a chronic inflammatory condition which has undergone degenerative or productive change, or extensive bullous œdema, will confuse or complicate the diagnosis.

Mortality includes deaths within 3 months of discharge. So-called cures were all followed for 6 months to 7 years, mostly 1 to 3 years.

In the treatment of high frequency currents the bipolar method was used altogether; the response in some papillomata to fulguration is very striking. I do not believe that high frequency is of any use in carcinomata except perhaps as a hæmostatic, nor have I found it satisfactory in extensive tumors at the vesical neck, mainly on account of difficulty of control in this area.

In cases of very extensive papillomatosis of the bladder, the cautery through a suprapubic incision gives more satisfactory results. In removing these growths by the suprapubic

TREATMENT	Cases	Total
Papilloma of bladder, malignant—39 cases		
Repeated fulguration		
Cured	12	
Improved	7	19
Cystotomy and cautery		
Cured	5	
Improved	1	6
Excision		
Cured	4	
Improved	2	6
Cautery and radium		
Cured	4	
Improved	1	5
Not treated	3	3
Carcinoma—78 cases		
Inoperable, not treated		27
Excision		
Cured	7	
Recurrence	6	
Died	1	14
Excision and cautery		
Cured	2	
Improved	1	3
Excision and radium		
Cured	2	
Improved	2	4
Cautery and radium		
Cured	4	
Recurrence	1	
Died	1	6
Excision and transplantation of ureter, cured		1
Excision and transplantation of ureter and radium, died		1
(This patient died from metastases 5 months later.)		
Cautery and fulguration being only palliative efforts in advanced cases		
Cured	1	
Recurrence	4	
Not improved	5	
Died	1	11
Deep X-ray, inoperable cases		
Improved	2	
Not improved	3	
Died	1	6
Suprapubic drainage for advanced inoperable conditions		
Not improved	1	
Died	4	5

route the operator must remember the property of epithelial cells to grow on denuded surfaces. Therefore, we must develop a method which prevents implants; we must destroy the tumor *in situ*, sponge as little as possible, and protect the perivesical space and the wound in the abdominal wall so that no accidental implants may result.

In the surgical technique for the removal of bladder tumors, we have used for a number of years the method of approach favored by Beer, Squier, and others, namely, the extraperitoneal liberation of the bladder permitting the drawing of the organ well out of its peritoneal and perivesical coverings, so that when the bladder is opened it is about two-thirds out of the abdomen.

Briefly the technique is as follows:

The bladder is irrigated gently with warm boric or salt solution, and the patient is put in the Trendelenburg position. A free median suprapubic incision is made to the bladder, which is not opened at present. The peritoneal fold is carefully separated; the urachus is liberated, clamped, cut, and the upper stump ligated. The lower stump is used to draw the bladder toward the symphysis, while the operator separates the peritoneum from the posterior wall of the bladder. The bladder is now well through the wound, and the abdominal wound is well protected with gauze. The bladder is opened almost anywhere, depending on the location of the growth or growths, and with the electric cautery the tumors are destroyed *in situ*, with as little manipulation and sponging as possible. If the case is one of benign papillomatosis, complete destruction with cautery well into the bladder wall is sufficient. If, however, the cystoscopic and microscopic examination, and the palpation at the operation suggests malignancy, the underlying bladder wall must be widely excised. If the tumor involves a ureteral orifice it is best to excise the tumor and about 2 centimeters of ureter. The ureter is reanastomosed with the bladder by puncturing a healthy part of the bladder wall and drawing the ureter through for about 1 centimeter, after splitting it into two lips and attaching it by catgut suture to the bladder.

The incision in the bladder wall, and in extension cases, the inside of the bladder, is swabbed with carbolic acid, and the wound and bladder are filled with alcohol for 3 minutes, with the object of coagulating any viable tumor cells which may be about. The table is now returned to horizontal position. The wound is closed with a suprapubic tube to the bladder, and an extravesical cigarette drain is placed along the operation incision in the bladder and through the suprapubic wound.

In the radium treatment, emanation seeds were used and inserted through a hollow needle.

When deep X-ray treatments were given, they consisted of a series of 4 treatments of

200 kilovolts, 5 milliamperes, 16 inches distance, and exposure for 60 minutes. The rays are filtered through one millimeter of copper, and one millimeter of aluminium. One exposure is given over the symphysis, one over the sacrum, and one over the right and left sacro-iliac joints. This is repeated at the end of 6 weeks.

CONCLUSION

In conclusion our experience has taught us that certain considerations must be emphasized with care in the attempt to solve this grave problem. The importance of recognition of blood in the urine cannot be overestimated; the examination of the prostate is of equal necessity; the age and development of the growth must be carefully decided; the location of the growth must be definitely settled; freer and more open surgical methods, even in cases of recurrence, must be followed; and finally a more thorough and reliable follow-up system, extending over the remainder of the patient's life, must be adopted. If these considerations and theories are followed with careful practice, our experience convinces us that the ravages of bladder cancer will greatly diminish.

BIBLIOGRAPHY

BUERGER, LEO. New York M. J., 1916, civ, 841.
BARRINGER, B. S. Surg., Gynec. & Obst., 1920, xxx, 86.
LOWER. Ann. Surg., 1922, 352.
KAUFMANN. Spezielle pathologische Anatomic, 1922, 1127.
MACKENZIE, D. W. Surg., Gynec. & Obst., 1924, xxxix, 155–156.
OERTEL. Personal communication.
BEER, EDWIN. Ann. Surg., 1921, lxxiii, 72.
CHRISTELLER. Ztschr. f. Urol., 1925, xix, 103.

CERTAIN CONSIDERATIONS IN THE TECHNIQUE OF GALL-BLADDER SURGERY

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THE unexpected drainage of bile[1] in the first few days following a simple cholecystectomy has often puzzled surgeons as to its cause. Cessation of this bile drainage within a few days practically precludes the assumption that the cystic duct ligature has failed, as it seems highly improbable that the cystic duct, once opened, should again close over so quickly. Another explanation is necessary, and it is suggested that in certain cases small biliary passages are opened up while the gall bladder is being removed from its bed, particularly if liver tissue is injured in the course of this dissection. Pertinent evidence was obtained recently indicating that abnormal and anomalous branches of the biliary system may also be severed in the course of an operation, and that these divided ducts may be the source of considerable bile drainage unless ligated. The 3 following cases are presented in this connection.

CASE 1. Figure 1. E. C., a woman, aged 53 years, was admitted to the Peter Bent Brigham Hospital on June 18, 1924, complaining of epigastric distress. Her first illness had occurred 3 years previously and had consisted of severe epigastric discomfort accompanied by marked distention and vomiting. Since that time the illness had recurred repeatedly at intervals of 2 to 3 months, until last October, when there occurred an acute attack of pain which was almost unbearable in its intensity, but which subsided suddenly after about 2 hours' duration. This attack was accompanied by a severe chill which recurred thereafter at frequent intervals, and by an intense jaundice which remained unabated for 2 months. During this time she was confined to bed, suffering with frequent chills and a dull epigastric distress. There was no further severe pain, but a definite alteration in symptoms, namely, the appearance of a persistent "heart burn" with marked increase in the feeling of distention and

[1] In a recent statistical study by Blalock (Johns Hopkins Hosp. Bull., 1924, xxxv, 391) it was noted that postoperative bile drainage occurred in 38 per cent of the simple cholecystectomies. In a study by Holman of 68 simple cholecystectomies done during the years 1919–1923, it was found that a certain amount of bile drainage occurred in 22 instances. It ceased on the first day in 1 case, on the fourth day in 2 cases, on the sixth day in 6 cases, on the seventh day in 2 cases, on the eighth day in 2 cases, on the tenth day in 2 cases, on the eleventh day in 1 case, on the fifteenth day in 1 case, on the eighteenth day in 2 cases, on the twenty-second day in 1 case, on the twenty-third day in 1 case, and on the twenty-fifth day in 1 case. The drainage was "slight to profuse." The cases were operated upon by 5 different operators, each closing the cystic duct by his own individual method, some preferring catgut, others silk, but using in most of the cases two ligatures—the first a simple ligature, the second a transfixion ligature.

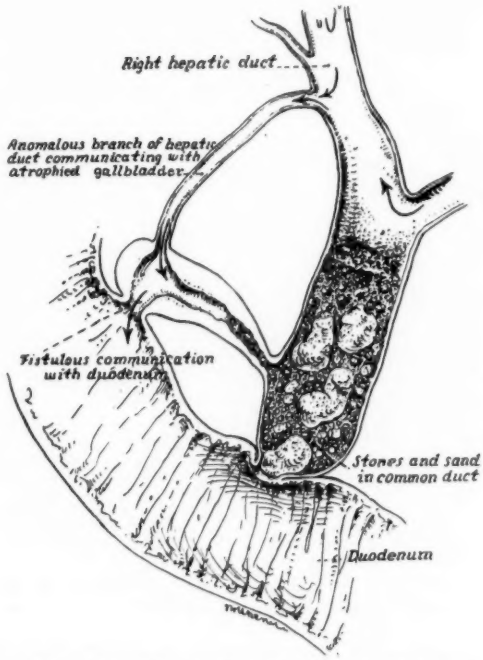

Right hepatic duct
Anomalous branch of hepatic duct communicating with atrophied gallbladder
Fistulous communication with duodenum
Stones and sand in common duct
Duodenum

Fig. 1. A large abnormal hepatic duct and a cholecystoduodenal fistula providing the only pathway for the escape of bile into the intestinal canal. This duct was discovered during an operation.

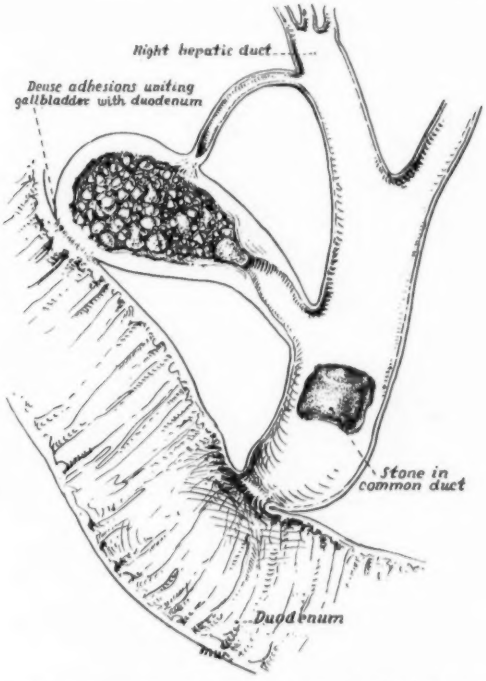


Fig. 2. Dense fibrous adhesions between gall bladder and duodenum, and an anomalous hepatic duct, suggest a process similar to that pictured in Figure 1, either uncompleted or healed.

in the belching of gas. In the 4 months preceding admission there had been frequent periods of severe headache, with the ever-present epigastric discomfort, but no evident jaundice. On admission, several days following another acute attack of exceedingly severe pain which had again been ushered in by a chill, there was no jaundice, and only slight residual tenderness in the epigastrium.

Fluoroscopic and roentgenological studies revealed "a small defect in the pylorus which was concave in appearance; a moderate gastric residue, with a small duodenal cap that was constantly irregular." These findings were interpreted as indicating an indurated lesion at the pylorus, which was either an ulcer or early carcinoma.

However, on the basis of a clinical diagnosis of gall stones, an operation was performed, and the following picture was disclosed, which could be easily correlated with the above clinical history (Fig. 1): Dense fibrous adhesions between the anterior abdominal wall and the liver surface prevented the usual downward displacement of the liver. The duodenum and omentum were also firmly adherent to the under surface of the liver. Freeing these adhesions revealed a greatly contracted gall bladder about the size of the end of the thumb. In attempting to free this from the duodenum, bile suddenly escaped through an opening which proved to be a fistulous communication between the gall bladder and the duodenum. The dissection was continued, a cystic duct about 4 millimeters in diameter was isolated, and a greatly enlarged common duct, 1.8 centimeters in diameter, was disclosed. In dissecting free the gall bladder from the under surface of the liver a small duct, 2 millimeters in diameter, was divided, which proved to be an abnormal communication between the gall bladder and the hepatic ducts. Bile leaked from the cut hepatic end, necessitating ligation of this abnormal duct. The other cut end opened directly into the small contracted gall bladder. The common duct was opened and found to be compactly filled with irregularly formed gall stones and a large amount of "mud" and "sand." It was evident that no bile had flowed through the usual route, but that it must have passed through the circuitous path indicated in Figure 1. The common duct was thoroughly evacuated and drained through the cystic duct by means of a No. 12 catheter, the longitudinal opening in the duct being completely closed with fine silk. The fistulous opening into the duodenum was closed

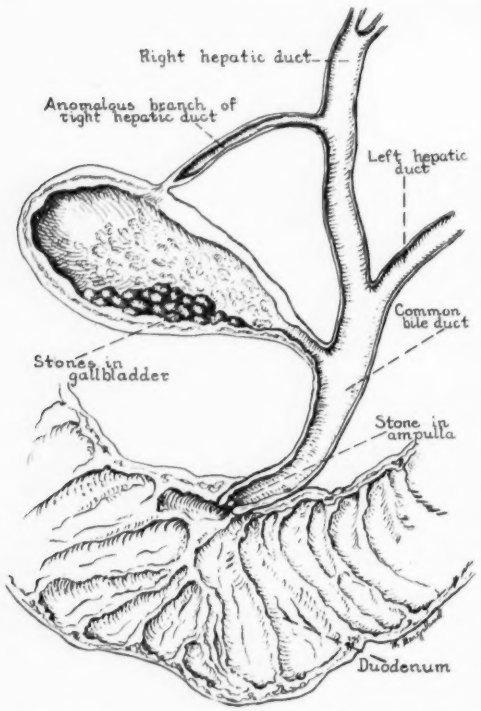


Fig. 3. Anomalous hepatic duct firmly attached to the gall-bladder wall which required ligation at operation.

and covered with omentum. Two cigarette drains were placed down to the foramen of Winslow. The patient made an uneventful recovery.

CASE 2. Figure 2. M. T., a woman of 70, presented, on admission to the Peter Bent Brigham Hospital, a characteristic history of gall-bladder disease, with increasingly severe attacks of pain extending over a period of 50 years. At the age of 18 she was troubled with epigastric discomfort attributed to indigestion, which reappeared at intervals of 3 to 4 months, and was relieved by vomiting and the belching of gas. This discomfort finally gave place to attacks of pain of increasing frequency and severity, until they became almost intolerable in their intensity and daily recurrence. In the course of some of these attacks she became irrational. The first jaundice appeared 2 years before admission, accompanied by chills and fever. The jaundice has recurred at frequent intervals, but quite as quickly disappears.

At operation the following picture was found (Fig. 2): The duodenum was densely adherent to the fundus of the gall bladder, as was the omentum. In freeing the duodenum the gall bladder was opened, and although no opening into the duodenum was demonstrable, the dense fibrous deposits indicated the possibility of an old fistulous communication; at any rate, a destruction of the gall-bladder wall, if not of the duodenum, was suggested. The gall bladder was with difficulty freed from the under surface of the liver, where there was also considerable fibrous tissue reaction. In the dissection, an anomalous hepatic duct, 2 to 3 millimeters in diameter, was divided with the escape of clear yellow bile. This duct, which required ligation, entered the liver substance, but its distal end was lost in the fibrous wall of the gall bladder. It seemed quite possible that at the point of its attachment there had occurred at some time in the course of the disease a destruction of the gall-bladder wall with erosion of liver substance and the establishment of a fistulous communication between a liver duct and the gall bladder, with subsequent closure by healing. A hugely dilated common duct was disclosed, fully 2 centimeters in diameter. It contained a large stone, which was removed through a longitudinal opening. This opening was closed with interrupted sutures of silk, and the common duct drained by means of a No. 14 catheter introduced through the cystic duct. The patient made an uncomplicated recovery and left the hospital on the twentieth day following operation.

CASE 3. Figure 3. B. K., a Russian Jewess, 43 years old, who was admitted to Lakeside Hospital on November 8, 1924, had been operated upon 10 years previously for gall-bladder disease following several attacks of severe right upper quadrant pain. She remained well for 4 years, when she began having similar attacks of pain, although not as severe nor as prolonged. During the past 6 months the pain has increased in severity and frequency, and in the last 8 weeks has been accompanied by jaundice of fluctuating intensity, and by excessive vomiting. On admission there were local tenderness and spasm over the old incision, a slight jaundice, and repeated vomiting. She was operated upon again, and the following observations made: The liver and gall bladder were densely adherent to the under surface of the old wound, indicating a previous cholecystostomy. Separation of the gall bladder from the under surface of the liver was effected with considerable difficulty, due to very dense fibrous deposits. In the course of this dissection a relatively large duct, fully 3 millimeters in diameter, was divided, with the escape of clear yellow bile. This duct could be easily followed on the surface of the liver for about 2 centimeters, when it disappeared in the parenchyma of the right lobe. The liver substance was not injured. The other portion of this anomalous duct ended blindly in the thickened fibrous wall of the gall bladder. The cystic duct was then identified, emptying into the common duct in the usual manner. The common duct was somewhat dilated to about 1.2 centimeters in diameter. The gall bladder was removed to facilitate exposure of the common duct, and it was found to contain numerous small irregularly formed stones and considerable "mud." The common duct was opened, some soft black mud was removed from the ampulla, the opening into the duodenum was dilated until it

easily admitted a large scoop, and the common duct was thoroughly irrigated. The longitudinal opening was partially closed and the duct drained by a catheter placed in the upper angle of the incision. The cystic duct was ligated. Complete recovery followed the operation.

The above observations are probably unusual with respect to the large size of these abnormal or anomalous branches of the intrahepatic ducts, but it is reasonable to suppose that smaller similar ducts may be severed which escape both identification and ligation. Leakage from them would explain, in certain instances, the bile staining on dressings removed during the first 3 to 4 days following operation, a staining which ends too soon and too abruptly to be ascribed to cystic duct drainage, and the amount is often too profuse to be accounted for by bile lost in the peritoneal cavity at the operation. These observations provide justification for drainage following cholecystectomy. Every effort should be made also to obliterate the raw bed of the gall bladder by bringing together its peritoneal edges with a continuous suture. In addition to peritonealizing a raw surface, this procedure may also serve to prevent bile leakage from small, divided, but unidentified, ducts.

LIGATION OF THE CYSTIC DUCT

Several years ago, at the suggestion of Dr. Halsted, I undertook a few experiments[1] in dogs to determine the results of ligation of the cystic duct according to the various methods then in use. Uniformly good healing followed the application of a single silk ligature to the cystic duct, and no untoward complications, such as a "bile peritonitis" or abscess formation followed. Drains, of course, were not used, there being no indication in any of the animals used that an infection of the biliary passages was present.

In 12 other dogs the cystic duct was ligated at two points by simple silk sutures placed 1 centimeter apart. In 7 of these cases, sacrificed at intervals of 6, 17, 30, 49, 66, 81, and 184 days respectively, small cysts were found at autopsy (Fig. 4) located between the two silk ligatures. In a strictly aseptic field,

[1] Performed at the Hunterian Laboratory of Experimental Surgery, Johns Hopkins Medical School.

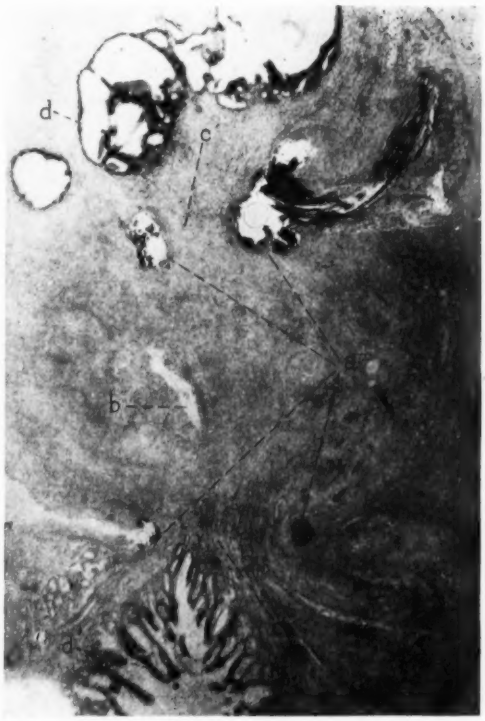


Fig. 4. Eighteen-day specimen of cystic duct ligated with two silk sutures 1 centimeter apart.

a, Silk suture in crosssection. *b*, Beginning cyst formation surrounded by degenerating and necrotic duct wall. *c*, Necrosis of duct epithelium with fibrous tissue substitution.

such a cyst formation is probably of little consequence. It is quite apparent, however, that the application of two ligatures in the presence of *infected* bile might lead to the formation of a localized cystic duct abscess, which might or might not eventually find its way to the surface. It is not difficult to recall experiences which could be attributed to such an abscess. Several unfortunate experiences have been called to my attention in which the patients died following simple cholecystectomy with symptoms of peritonitis. At necropsy the abdomen was found filled with bile and the cystic duct wide open.

The failure of cystic duct closure in such instances is difficult to explain. Is it to be attributed to the location of drains, to a localized infection with abscess formation, to a too

rapid absorption of catgut, or to excessive trauma? We do not know, but in the face of our experimental evidence, the double ligature has been avoided and the following simple procedure adopted:

The duct is carefully ligated with a single strand of medium black silk. A French needle is threaded on one end of this same ligature, which is then transfixed in place by passing the needle through the stump of the cystic duct at a point *immediately* beyond the location of the ligature. The threads are again tied. The needle is never introduced proximal to the ligature, since bile leakage around the stitch holes may occur. An attempt is made in each instance to cover this ligature with folds of peritoneum, in order that the drain may not lie directly against the open end of the stump or the ligature. No bile drainage or postoperative complication which could be directly attributed to cystic duct leakage has been encountered since the adoption of this procedure.

In the experiments on cystic duct ligation an interesting observation was made on the healing that occurs following application of the ligature. Several years ago Dr. Halsted called attention to the healing process that follows ligation of an artery[1]: "The infolded and snugly opposed intimal surfaces under the compressing band have in no instance adhered to each other, and for the reason that the pressure necessary to produce even a very slight reduction in the lumen of the vessel has, in my experience, invariably caused atrophy of its wall. When the occlusion is complete, the necrotic arterial wall included in the metal band becomes replaced by a solid cylindrical cord of fibrous tissue, the substitution taking place from the ends."

A similar process apparently occurs within the ligature closing the cystic duct (Fig. 4). There is necrosis of the included duct wall with fibrous tissue substitution, but it is evident from our experiments that this fibrous tissue may subsequently be absorbed so that the ligature becomes entirely freed and is found lying on the surface of the liver, covered only by peritoneum. This was repeatedly noted in the older specimens, for example, in one of 134 days' duration and in another of 147 days' duration. This freeing of the ligature is quite comparable to the extrusion of silk ligatures in intestinal suture and in the healing of abdominal wounds.[2]

[1] W. S. Halsted. Dilation of the great arteries distal to partially occluding bands. Proc. Nat. Acad. Sc., 1918, iv, 204.

[2] Reichert and Holman. The fate of the sutures as observed in intestinal anastomosis and in the healing of wounds. Johns Hopkins Hosp. Bull., 1925, xxxvi, 212–221.

SUMMARY

Anomalous branches of the hepatic duct may be responsible for slight or moderate postoperative bile drainage which is unexplained by a reopened cystic duct. The danger of bile leakage from divided but unidentified ducts suggests that drainage is a necessity even in simple cholecystectomy.

Double ligation of the cystic duct is contraindicated by the possibility of cyst formation between the ligatures, followed in the presence of infected bile by a localized abscess.

The healing that occurs in a ligated cystic duct is comparable to the healing of a ligated artery. Necrosis of the duct wall occurs with fibrous tissue substitution. This fibrous tissue is later reabsorbed, and the ligature freed, unless, of course, an absorbable suture has been employed. No ill effects attributable to the use of silk have been encountered.

THE CANCER CELL AND NATURE'S DEFENSIVE MECHANISM[1]

By WILLIAM CARPENTER MacCARTY, M.D., Rochester, Minnesota

THE human body is an organism composed of groups of cells of at least forty-five different types, all of which have evolved from a fertilized human ovum (Fig. 1). In this evolution, fertilization, segmentation, differentiation,[2] and specialization occur. Tissue differentiation, in the human body, occurs in such a manner that it may be divided into three recognizable stages (Fig. 2): first, the establishment of the general alignment of the cells which is seen in the normal arrangement of adult tissue—the cells themselves remaining undifferentiated; second, the establishment of cellular polarity such as is seen in fully differentiated tissue; and, third, the establishment of adult morphology of the cells. In the condition of no differentiation, and the first and second stages, just described, the cells bear no morphological resemblance to their adult forms.

During differentiation and specialization nature provides for the two natural phenomena of destruction and regeneration, one a cause and the other an effect. The biological phenomenom of destruction of any tissue may be caused by many things and conditions; the specific causes of destruction vary. Regeneration of adult tissues occurs in two ways in the human body: directly (regeneration of adult cells from adult cells), and indirectly (regeneration from reserve cells). The malignant cell or the cell which has been called a "cancer cell," in which we are clinically especially interested, is evolved from a reserve cell although it may be derived directly from a cell which is normally regenerated directly. The study of the malignant cell, its behavior, and the natural defensive reactions of the organism to its abnormal proliferation and invasion of the rest of the body, constitutes a problem of greatest practical economic importance. Accurate knowledge of the cell's origin, the conditions which promote its proliferation, its attempts at differentiation, its invasive qualities, and the body's method of preventing furthur destruction will provide us with a means of preventing cancer—a service far greater than curing it. Any means of early recognition which will allow early removal—the only known method of cure—is well worth our intense consideration.

It should be worth something even to those who correctly or incorrectly hold the parasitic theory of etiology of cancer to know just what cells are affected by parasites. It may also be of value in impressing upon the medical profession as well as the specific cancer investigators that the etiology of cancer is something which probably involves many factors besides parasites. In all probability there is what might be called an essential pathology (a physicochemical condition) necessary before parasites invade and give gross clinical entity to all known parasitic diseases.

Perhaps the simplest way to convey the facts to the medical profession, as they have been seen in the biological and cytological study of neoplasmata, is for us to confine our attention to principles in one organ. In Figure 3 one sees diagrammatically illustrated the evolution of the milk-producing cells of the mammary gland. From the ectoblastic layer of the three layer stage of development of the embryo, the cells of the stratum germinativum of the fetal skin arise; from them, by differentiation, arise the fetal squamous cells. Also from them, by multiplication, down growth into the subepithelial tissues, and differentiation, the lining cells of the mammary tubules and acini arise. It may be seen that there are two layers of cells in each normal mammary acinus. The cells lying adjacent to the lumen are secretory (adenocytes) and those lying next to the stroma are the reserve cells (adenoblasts). In chronic mastitis some one or more unknown things or conditions destroy the secretory cells; the reserve cells become hypertrophic or enlarged. This is a common picture in chronic mastitis with or without the presence of cancer. In some chronic mas-

[2]A biological term referring to structural changes in contradistinction to specialization which has to do only with function.

[1]Read before the Clinical Congress of the American College of Surgeons, New York, October 1924.

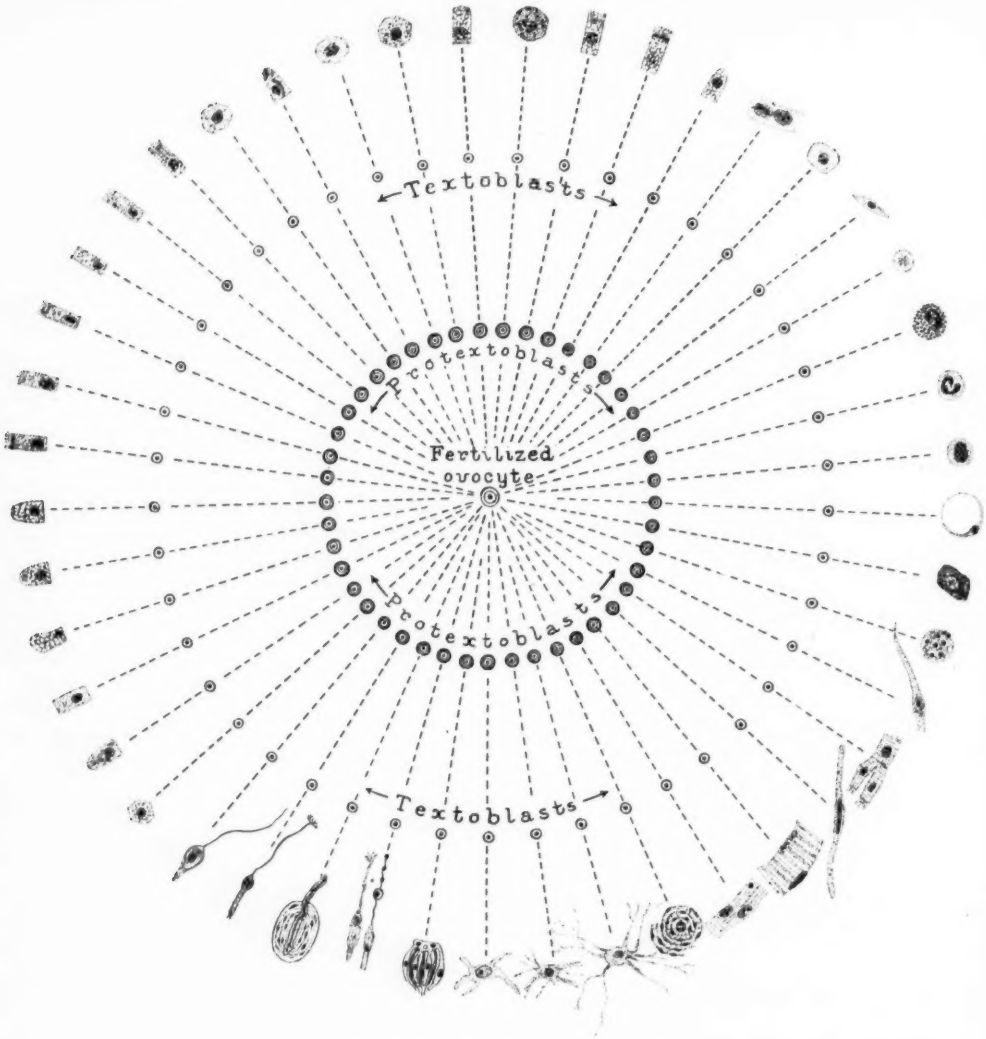


Fig. 1. Diagram showing the evolution of at least forty-five different types of cells which constitute the tissues of the human body. No attempt is made to picture the exact morphology of each type although some of their characteristics are suggested.

tidides, some of the acini reveal the fact that the reserve cells not only become hypertrophic, under the condition of destruction of the secretory cells, but also become hyperplastic; they increase in number and partially or completely fill the acinus. In this condition the cells are undifferentiated; they have larger nucleoli and nuclei than do adult or differentiated cells. The undifferentiated cells are frequently indistinguishable from those of cancer despite the fact that they are still within the confines of the acinus. In some

acini, in some chronic mastidides in which this proliferative condition exists, one finds the line of demarcation between acinus and stroma destroyed by the migration of undifferentiated cells. The last picture is the one we call cancer; the cells are of the type seen in Figures 4 and 5.

The question arises: Has the malignant cell a morphology by which it may be recognized? Text-books describe the cancer cell as having an irregular shape with an irregularly shaped nucleus which takes the stains densely and frequently shows an assymetrical mitotic figure. This description applies to those cells in pathological tissues which have been dead for some time—have undergone cytological changes coincident to and following death—and have been fixed in strong solutions and then embedded in celloidin or paraffin. It is not the picture which one sees in living tissues or tissues which, although dead, have just died and are studied in an unfixed condition with oil lenses. Under these less destructive conditions the cancer cell is an ovoidal or spheroidal body with no irregularities of "cell wall," nucleus or nucleolus; the demarcations of the component parts of the cell are perfectly sharp and distinct; the granules of the cytoplasm and nucleoplasm are fairly uniform in size; the mitotic figures are sometimes multipolar but they are not assymetrical and irregular in my experience. The whole cell when studied in the fresh condition is the object of study; it is not cut in planes. Its constituents are not coagulated and are therefore transparent or translucent; there is no necessity for thin sections such as one attempts to obtain with celloidin and paraffin methods.

Many pathologists have said that it is impossible and unsafe to diagnose cancer from single cells; they prefer low-power histological studies. For pathologists who have not made a detailed high-power study of the forty-five adult cells, the characteristics of cells in normal regenerative stages, do not understand the details of cellular differentiation, and have not studied living and fresh malignant cells with the oil lenses the diagnosis must be impossible and unsafe.

The cancer cell may not always be distinguished from a normal regenerating cell, but

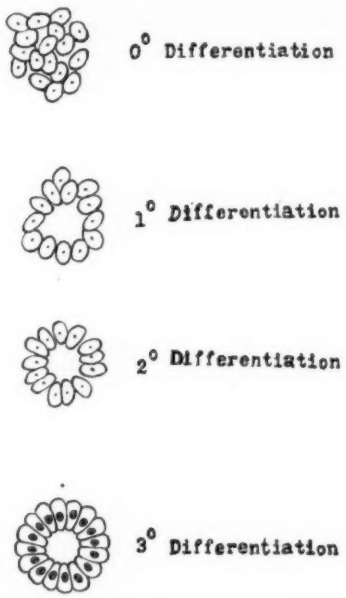


Fig. 2. Diagrammatic representation of the recognizable stages of differentiation of a gland unit during normal embryological development. It also represents the stages of differentiation in neoplastic conditions.

this can be done frequently because there is a difference in volume-relationship between nucleolus, nucleus, and the whole cell in the reparative regenerative cells and malignant regenerative cells. There is also a difference in the density of the nucleoplasm and cytoplasm in the extreme exemplars of these two cells. The regenerative cell is more delicately constructed (Figure 6) and its nuclear granules are usually finer; the nucleoli are smaller in proportion to the size of the nucleus and the whole cell. These are some of the differential points. There are qualities which words cannot describe. One learns to recognize the types of cells from experience with actual clinical proof of diagnosis and prognosis just as one recognizes members of his family and friends. It is not always possible to describe our friends in such a manner that others can recognize them. Expertness in the differential recognition of malignant cells, reparative regenerative cells, and adult cells comes through constant contact with them, checked

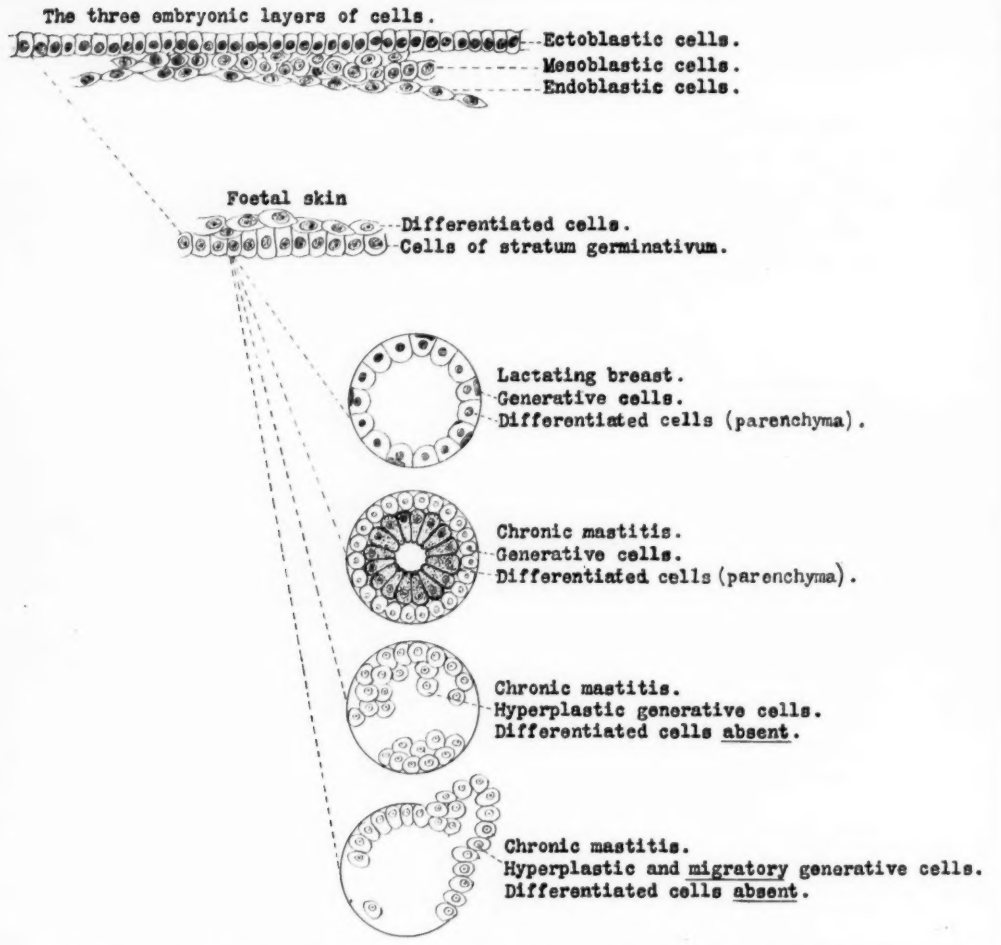


Fig. 3. Diagrammatic representation of the evolution of a mammary acinus with its two types of cells (adenoblasts and adenocytes). The lower three diagrams show the three changes which are found in chronic mastitis. They represent hypertrophy, hyperplasia, and migration of adenoblasts. The migratory stage is malignant and the hyperplastic stage is potentially malignant.

by clinical proof of diagnosis. The problem is one of cytology, not histology. The malignant cells which have just been described are malignant because they invade the surrounding tissues, spread to distant parts of the body where they multiply independently, disturb the vitality of the whole organism directly and indirectly, and eventually cause death.

The body provides for a certain amount of protection against malignant invasion by causing hosts of lymphocytes to migrate to the field of action (Figure 7, *a*, *b*) and to surround the area which is filled with malignant cells. It also builds a fibrous connective tissue barrier (Figure 7, *c*, *d*) around them and sometimes increases the density of this by hyalinization (Figure 7, *e*, *f*). There is great variability in the occurrence of these reactions in different individuals and in different organs of the body; there is probably some

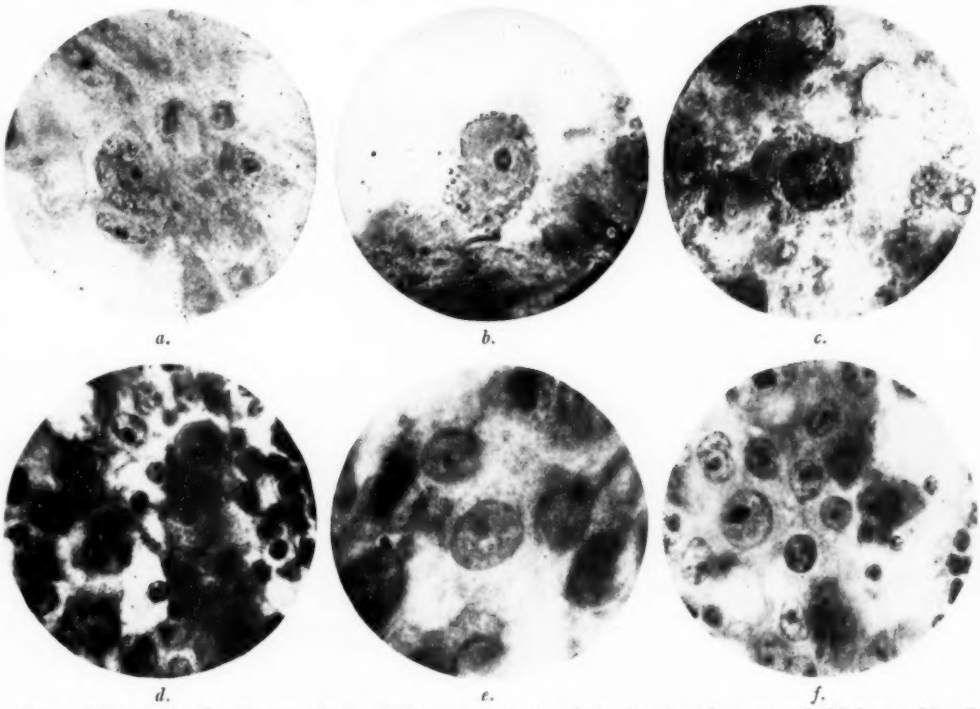


Fig. 4. Photographs of malignant cells in a living state (*a*, *b*, *c*) and also in a fixed but not embedded state (*d*, *e*, *f*). These cells have positive diagnostic morphology.

variation at different times in the same body. Thus one does not always find them present or finds them in different degrees of intensity. The following table shows the frequency of the defensive factors in the organs which have been studied:

	Stomach 99 cases Per cent	Breast 92 cases Per cent	Rectum 102 cases Per cent	Skin 29 cases Per cent
Frequency of differentiation.	65	8.6	86	65.5
Frequency of lymphocytic infiltration	91	60	57	65.5
Frequency of fibrosis	..	68	75	41.3
Frequency of hyalinization	..	52	2	31.0
Frequency of differentiation and lymphocytic infiltration	..	6	56	37.9
Frequency of differentiation and fibrosis	..	7	70	27.5
Frequency of differentiation and hyalinization	..	4	2	17.2
Frequency of lymphocytic infiltration and fibrosis	..	40	47	24.1
Frequency of lymphocytic infiltration and hyalinization	..	27	1	20.6
Frequency of fibrosis and hyalinization	..	52	2	27.5

Whether differentiation is a defensive factor or a cellular reaction to lymphocytic infiltration, fibrosis and hyalinization remains yet to be shown. Theoretically—as in normal differentiation—it is the result of a favorable environment. Regardless of its cause there are certain clinical facts which are significant. Thus we see in the following figures that there is a greater average length of postoperative life when differentiation is present.

	Stomach 99 cases yrs.	Breast 92 cases yrs.	Rectum 102 cases yrs.	Skin 29 cases days
Average length of postoperative life with differentiation	2.73	3.65	1.54	534.1
Average length of postoperative life without differentiation	2.65	2.37	1.08	274.7

In this series all patients were known to be dead from recurrence of their lesion or metastases. Since these observations were made, Dr. Broders has studied a series of epithelio-

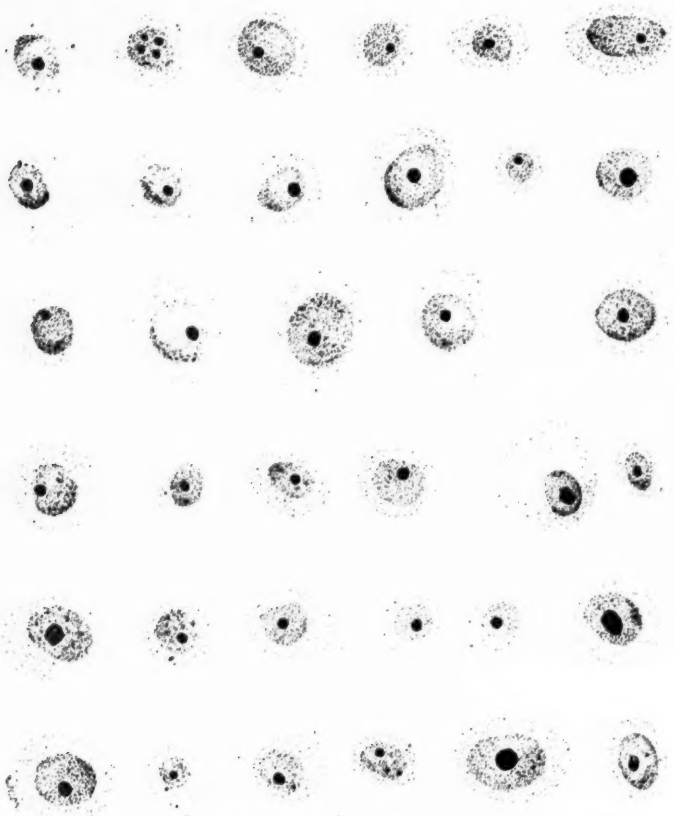
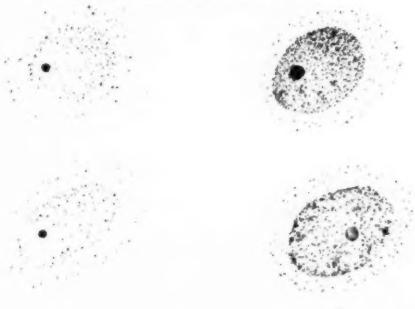


Fig. 5. Sketches to scale of malignant cells from many sources. They represent those for carcinoma, sarcoma, lymphosarcoma, lymphatic leukæmia, and malignant endothelioma. It is impossible to differentiate one from the other but each one has a morphology unlike any normal regenerative or adult cell in the human body.

mata with interesting results which also emphasize the value of differentiation as one of the factors to be taken into consideration in studying prognosis. In his series, he considered all cases whether dead or alive; he graded his microscopic sections in the following manner: When three-fourths of the cells were differentiated and one-fourth not differentiated the condition was graded I; when one-half of the cells were differentiated and one-half undifferentiated, it was graded II; when one-fourth of the cells were differentiated and three-fourths undifferentiated it was graded III, and when there was no differentiation, it was graded IV.



a b

Fig. 6. Diagrammatic sketches of reparative regenerative cells and malignant regenerative cells to show some of the differences in morphology. The reparative cells are more delicate, have smaller granules and smaller nucleoli.

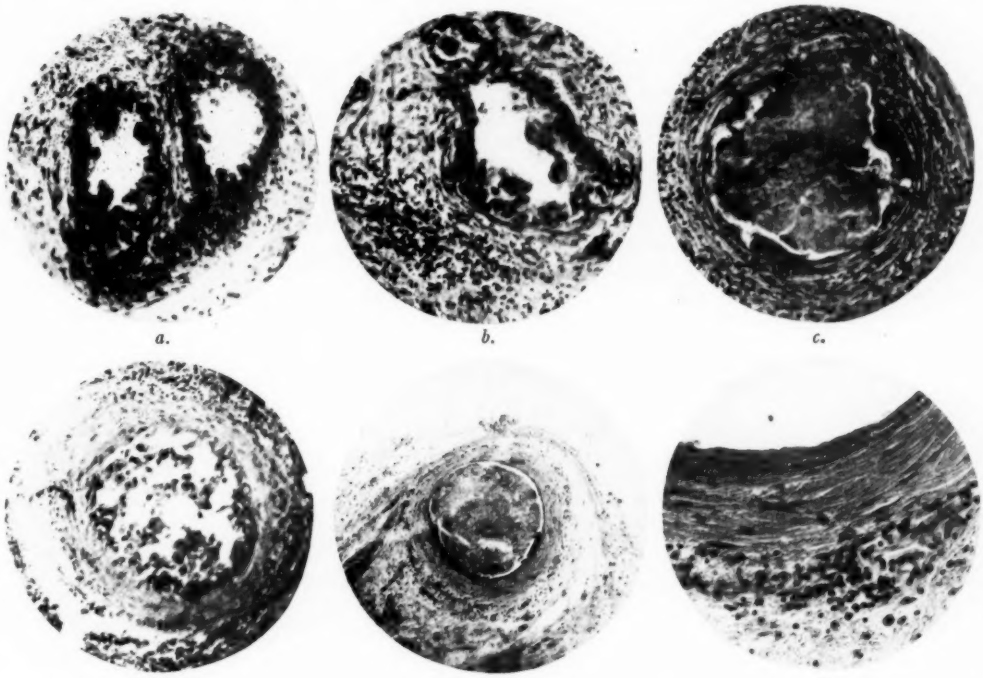


Fig. 7. Reactions seen in malignant neoplastic conditions, *a*, *b*, lymphocytic infiltrations; *c*, *d*, fibrosis and lymphocytic infiltration; *e*, *f*, hyalinization.

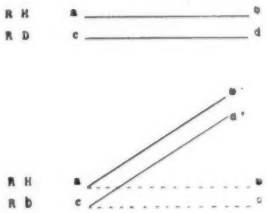


Fig. 8.

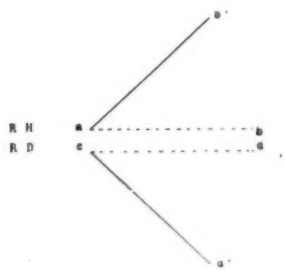


Fig. 9.

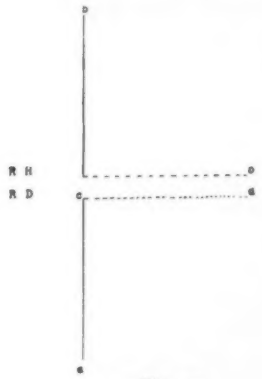


Fig. 10.

Fig. 8. The relation of the rate of hyperplasia (RH) to the rate of differentiation (RD). The two horizontal parallel lines *ab* and *cd* represent this relationship in the normal process of tissue repair. The lower figure represents an increase in the rate of hyperplasia and the rate of differentiation: the so-called benign neoplasmata. There is an overgrowth but the cells have adult morphology.

Fig. 9. Graphic representation of a condition one sees in the second group of neoplasmata; the rate of hyperplasia is increased and the rate of differentiation is relatively decreased. The cells of such neoplasmata have not adult morphology although they may approach adult arrangement of cells.

Fig. 10. Graphic representation of a third group of neoplasmata in which the rate of hyperplasia is increased and the rate of differentiation is reduced to zero. In this condition there is no resemblance to any adult tissue in cellular morphology or arrangement.

OPERATIVE RESULTS IN EPITHELIOMA IN RELATION TO CELLULAR DIFFERENTIATION

PERCENTAGE OF DEATHS

	G. U.	Skin	Head and neck	Lip
Grade I (¾ D)....	33.33	.....	75.00	.....
Grade II (½ D)....	81.08	61.29	93.20	54.90
Grade III (¼ D)....	96.33	85.71	98.30	84.21
Grade IV (No D)....	97.29	100.00	100.00	100.00

PERCENTAGE OF POOR RESULTS

	G. U.	Skin	Head and neck
Grade I (¾ D).....	8.33	.....	27.27
Grade II (½ D).....	49.18	25.92	63.95
Grade III (¼ D).....	75.00	54.16	90.62
Grade IV (No D).....	87.00	100.00	93.75

PERCENTAGE OF GOOD RESULTS

	G. U.	Skin	Head and neck
Grade I (¾ D).....	83.33	92.85	72.72
Grade II (½ D).....	45.90	65.43	34.88
Grade III (¼ D).....	25.00	41.66	9.37
Grade IV (No D).....	12.19	.....	6.25

It may be seen that the lowest percentage of deaths was in Grade I (three-fourths differentiation) and the highest percentage in Grade IV (no differentiation). A similar relation may be seen in his study of the good and poor results in those patients still alive; the highest percentage of good results occurred in Grade I (three-fourths differentiation) and the highest percentage of poor results in Grade IV (no differentiation). These facts in conjunction with those which had been previously observed in the stomach, breast, and rectum seem very significant.

The study of lymphocytic reaction, fibrosis and hyalinization also presents interesting facts.

	Stomach 99 cases yrs.	Breast 92 cases yrs.	Rectum 102 cases yrs.	Skin 29 cases days
Average length of post-operative life with lymphocytic infiltration.....	2.73	2.51	1.57	496.2
Average length of post-operative life without lymphocytic infiltration.....	2.7	2.48	1.31	346.6
Average length of post-operative life with fibrosis.....	....	2.72	1.53	655.7
Average length of post-operative life without fibrosis.....	....	1.87	1.29	295.6
Average length of post-operative life with hyalinization.....	....	2.81	2.33	449.6
Average length of post-operative life without hyalinization...	....	2.21	1.44	437.9

With an idea of studying which of these factors or combinations of factors was most important the following observations were made:

	Stomach 99 cases yrs.	Breast 92 cases yrs.	Rectum 102 cases yrs.	Skin 29 cases days
Average length of post-operative life with differentiation and lymphocytic infiltration.....	2.8	3.78	1.59	644.5
Average length of post-operative life without differentiation and lymphocytic infiltration.....	1.55	2.45	0.71	204.0
Average length of post-operative life with differentiation and fibrosis.....	....	3.87	1.58	808.3
Average length of post-operative life without differentiation and fibrosis.....	....	1.96	1.15	257.5
Average length of post-operative life with lymphocytic infiltration and fibrosis....	....	2.69	1.65	739.8
Average length of post-operative life without lymphocytic infiltration and fibrosis.....	....	1.4	1.17	155.2
Average length of post-operative life with lymphocytic infiltration and hyalinization.....	....	2.76	2.25	404.0
Average length of post-operative life without lymphocytic infiltration and hyalinization.....	....	1.68	1.27	255.5
Average length of post-operative life with fibrosis and hyalinization.....	....	2.89	2.33	453.8
Average length of post-operative life without fibrosis and hyalinization.....	....	2.05	1.28	282.5
Average length of post-operative life with differentiation and hyalinization.....	....	4.0	2.33	587.0
Average length of post-operative life without differentiation and hyalinization...	....	2.04	0.61	257.5

If the difference between the length of post-operative life with the individual factors and without them is not sufficiently great to warrant definite conclusions certainly the figures computed with all of the factors present

REPORT OF NEOPLASMATA

Gross Condition		Tissue, Organ or Region	Neoplastic Tissue	Differentiation		Symbols	
Circumscribed	—			0		Texto-blastoma	N
Diffuse	—			1		Pseudo-textoma	N1
Cystic	—			2			N2
Extracystic	—			3		Textoma	N3
Intracystic	—	Tissue Reaction	Lymphocytic Inf.		Fibrosis		Hyalinization
Intraductal	—	Size			Weight		
Periductal	—	Metastase					
Papillary	—	Remarks:					
Polypoid	—						
Ulcerated	—						
Hemorrhagic	—						
Encapsulated	—						
Calcareous	—						
Infected	—						
Colloid	—						
Multiple	—						
Degenerating	—						
Excrescent	—						

Fig. 11. Facsimile of a record form for neoplasmata. The reverse side of this card contains a form of clinical abstract.

checked against their complete absence may be significant.

	Stomach[1] 99 cases yrs.	Breast 92 cases yrs.	Rectum 102 cases yrs.	Skin 29 cases days
Average length of post-operative life with lymphocytic infiltration, differentiation, fibrosis, and hyalinization.....	....	4.4	2.25	444.6
Average length of post-operative life without lymphocytic infiltration, differentiation, fibrosis and hyalinization.....	....	1.52	0.76	54.0

Interesting and important as these facts are we must not forget that there are probably other conditions which influence longevity; one must not ignore age, lymphatic involvement, multiplicity of lesions, proximity to vital structures, duration of lesion, size of lesion, and general condition of the patient. With due consideration for these, plus the facts relative to lymphocytic infiltration, fibrosis, hyalinization, and differentiation one may very accurately prognosticate in the majority of instances.

The correlation of the presence and degree of differentiation with longevity in patients with neoplasmata is very significant in giving us a basis for grouping neoplasmata and recognizing clinical values in each group. *Malignancy is dependent upon a relationship between the rate of hyperplasia and the rate of differentiation.* Thus in normal tissue repair the rate of differentiation goes hand in hand with the rate of hyperplasia, a phenomenon which may be diagrammatically represented by two parallel horizontal lines (Figure 8). One finds, however, conditions in which the rate of hyperplasia is increased and the rate of differentiation is likewise increased. Such an overgrowth is composed of cells which have adult morphology such as one sees in moles, warts, fibromata, true adenomata, etc. This represents a definite group of neoplasmata regardless of what name we give them (Figure 8). One sees a second group in which there is an overgrowth of cells which, although arranged in the form of adult normal tissues, are still undifferentiated or partially differentiated; the rate of hyperplasia is increased and the rate of differentiation is relatively decreased (Figure 9). Since it is well known in nature that growth is indirectly proportional to the height of differentiation one would naturally suspect that this second group of tumors would grow more rapidly than the first. This group embraces such neoplasmata as adenocarcinoma, fibro-osteosarcoma, epitheli-

[1]Fibrosis and hyalinization occur so rarely in cancer of the stomach that calculation could not be made with any degree of accuracy.

oma with pearls, osteosarcoma, chondrosarcoma, etc. There is a third group in which there is no differentiation (Figure 10) and no arrangement of cells suggesting that of any normal tissue. This is the group to which very cellular sarcomata belong—a group which has been the dumping-ground for tumors of many different origins. Many of them do not belong in the sarcoma group if we still think of all sarcomata being only of mesoblastic origin.

The problem of terminology is always one which causes trouble. Despite the fact that I have previously given names[1] to these groups it is not the name in which we are vitally interested. Personally, I would just as soon call them by numbers or speak of them as Groups I, II, and III.

The accompanying form (Figure 11) has been used for recording the facts. The degrees of differentiation are numbered in the order of their normal evolution in nature and must not be confused with the clinical grading which Dr. Broders has used. For convenience in cataloging in a museum, symbols have been given. Thus N stands for neoplasm with no differentiation, N_1 and N_2 neoplasm with the first and second degree of differentiation,[2] and N_3 one with the third degree.

Thus there are three groups which embrace all possible neoplasmata with three different degrees of clinical significance. Each group may be subdivided according to organs or tissues if the organs and tissues are definitely known.

The tissue reactions may be readily recorded on the chart, from which one may prognosticate more scientifically and accurately than from any type of name which has ever been given to neoplasmata.

CONCLUSIONS

1. The cancer cell is an entity which can be recognized in the majority of instances by those who are trained in the study of fresh cells.

2. Cellular differentiation furnishes one definite factor upon which to formulate a prognosis. It is not the only factor.

3. Lymphocytic infiltration, fibrosis, and hyalinization apparently play a very great rôle in the human body's defense against cancer.

4. All neoplasmata may be divided into three definite groups each of which has definite clinical significance.

5. All of these facts, aiding in the early diagnosis of cancer, are of great value to patients; when used by trained individuals, they allow early apprehension of lesions which are too small to be recognized clinically or grossly.

[1] The human body is composed of texto-cytes (highly differentiated and specialized adult cells) and texto-blasts (undifferentiated or partially differentiated reserve cells for the regeneration of texto-cytes). Textomata are neoplasmata composed of texto-cytes; pseudotextomata, neoplasmata composed of partially differentiated texto-blasts; and textoblastomata, neoplasmata composed of undifferentiated texto-blasts.

[2] Despite the fact that there are two definite pictures seen in partial differentiation, for practical purposes all neoplasmata with partial differentiation might well be considered one group (Group II) for the present.

REFERENCES

MacCarty, W. C. Carcinoma of the breast. Old Dominion M. J., 1911, xii; Tr. South. Surg. and Gynec. Ass., 1910, xxiii, Dec.

Idem. Involvement of regional lymphatic glands in carcinoma of the stomach. Ann. Surg., 1912, June. (With J. M. Blackford, M.D.)

Idem. The histogenesis of cancer of the breast and its clinical significance. Surg., Gynec. & Obst., 1913, Oct.

Idem. Clinical suggestions based upon a study of primary, secondary (carcinoma?), and tertiary (carcinoma) epithelial hyperplasia in the breast. Surg., Gynec. & Obst., 1914, xviii, March.

Idem. The biologic position of the cancer cell. Pan-Am. M. & S. J., 1915, xx.

Idem. Precancerous conditions. J. Iowa State M. Soc., 1914, iv, April.

Idem. Notes on the regularity and similarity of cancer cells. Collected Papers of the Mayo Clinic, 1914, 600–602.

Idem. The relation between chronic mastitis and carcinoma of the breast. St. Paul M. J., 1916, xviii, May. (With E. H. Mensing, M.D.)

Idem. A new classification of neoplasms and its clinical value. Am. J. M. Sc., 1916, cli.

Idem. The evolution of cancer. Collected Papers of the Mayo Clinic, 1915, 903–917.

Idem. Studies in clinico-pathologic standardization and efficiency. Surg., Gynec. & Obst., 1917, xxiv, Dec. (With A. C. Broders, M.D.)

Idem. Cancer's place in general biology. Am. Naturalist, 1918.

Idem. The need and value of bio-pathological standardization. Surg., Gynec. & Obst., 1918, Nov.

Idem. Epithelioma. Surg., Gynec. & Obst., 1918, Aug. (With A. C. Broders, M.D.)

Idem. A biological conception of neoplasia, its terminology and clinical significance. Am. J. M. Sc., 1919, clvii, May.

Idem. Clinical efficiency and terminology in cancer of the breast. Surg., Gynec. & Obst., 1919, July. (With H. M. Connor, M.D.)

BRODERS, A. C. Squamous cell epithelioma of the lip. (A report of 537 cases.) J. Am. M. Ass., 1920, lxxiv, March 6.

MACCARTY, W. C. A mathematical terminology for neoplasia and its significance. Northwest Med., 1920, May.

Idem. A new clinical classification of neoplasms. J. Tennessee State M. Ass., 1921.

BRODERS, A. C. Squamous cell epithelioma of the skin. (A study of 256 cases.) Ann. Surg., 1921, Feb.

MACCARTY, W. C. Relation of differentiation and lymphocytic infiltration to postoperative longevity in gastric carcinoma. J. Lab. & Clin. Med., 1921, vi, June. (With A. E. Mahle, M.D.)

Idem. Life expectancy following radical amputation for cancer of the breast. (A clinical and pathological study of 218 cases.) Ann. Surg., 1922, Jan. (With W. E. Sistrunk, M.D.)

BRODERS, A. C. Epithelioma of the genito-urinary organs. (A study of 473 cases.) Ann. Surg., 1922, May.

MACCARTY, W. C. Efficiency in the diagnosis of neoplasms. Surg., Gynec. & Obst., 1922, Aug.

Idem. The relation of fibrosis and hyalinization to longevity in cancer. (A study of 194 cases.) J. Lab. & Clin. Med., 1922, viii, Oct.

Idem. Possible defensive factors in cancer of the rectum. (A study of 102 cases.) J. Lab. & Clin. Med., 1922, vii, July. (With J. K. W. Kehrer, M.D.)

Idem. Factors which influence longevity in cancer. (A study of 293 cases.) Ann. Surg., 1922, July.

Idem. The cytologic diagnosis of neoplasms. J. Am. M. Ass., 18, 1923, Aug.

Idem. Prognostic factors in cancer. Ann. Clin. Med., 1924, Jan.

BRODERS, A. C. Epithelioma of the cavities and organs of the head and neck. (In print.)

BONE FORMATION IN THE THYROID GLAND[1]

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THE following case history of extensive bone formation in the thyroid gland merits recording, from several points of view. In the first place, massive bone formation in the thyroid, so-called *struma ossea*, is not commonly encountered; in the second place, complete block of the sympathetic trunk in the neck, due to pressure by thyroid enlargement is a very unusual phenomenon, and finally, the case history calls into question the problem of calcification and ossification.

M. W., a male patient, 52 years old, entered the hospital October 17, 1923, complaining of general weakness, inability to continue his work as a laborer, lack of power of concentration, and a loss of about 20 pounds in weight during the past year. His family and past history were both strikingly negative.

His illness dated from a year ago when he noticed that after a few hours of work, objects became dim and he could not read the blue prints on his desk. This was followed by dizziness and weakness but after resting a while, he could resume his work. He stopped working for 2 days and then began again and remained perfectly well for 2 months. The symptoms then set in again, accompanied with pain in the head. This head pain was dull in character, distributed about the frontal region but never assuming the nature of an acute headache. These attacks of dizziness and weakness were repeated about once a month, growing slowly more severe with a tendency to be accompanied by somnolence. The dizziness is of short duration but if the patient happens to be standing at the time, he stumbles and has a tendency to fall. During these periods, his arms and legs "get weak." He finally quit work on September 10, on account of dizziness, weakness, and pain in the head. Errors of refraction had been corrected by glasses a year and a half before the onset of the present illness. There is no history of impairment of hearing, taste, or smell.

The patient, a well developed man of 52 years of age, showed clearly that he had lost weight. Facial expression was placid and not indicative of pain at the time of examination. Skin and mucous membranes are fairly normal in color. Growth and distribution of hair are normal. The ears are grossly negative. There is no impairment of hearing, no mastoid tenderness. The nose is negative; there is no nasal obstruction, no sinus tenderness. The eyes show enophthalmos with hypotonia of the left globe. The left palpebral fissure is slightly but definitely narrower than right. The scleræ are clear. The left pupil is much smaller than the right. The pupils are regular in outline and react promptly to light but sluggishly to distance. External ocular movements are normal. The media are clear in both eyes and the disks are normal. The maculæ and peripheries are normal. The vessels are normal in contour and outline. Refraction in both eyes +1. The mouth shows mucous membrane of good color, teeth worn, tongue clean, slightly tremulous and not deviating on protrusion. The pharynx is negative. The tonsils are negative. The neck shows on inspection a fullness at the base, extending to both sides of the mid-line, particularly prominent on the left side. Carotid pulsation is visible. The anterior chain of lymph nodes are enlarged on the left side, with a few enlarged nodes on the right side. The fullness at the base of the neck is clearly an enlarged thyroid, which is larger on the left, where it dips under the sternocleidomastoid muscle. The tumor moves on deglutition, is somewhat irregular in outline on palpation (adenomata), and has the consistency of ordinary hypertrophic thyroid tissue. Range of neck movements is normal and no pain or tenderness is present on palpation. There is no tracheal tug. The chest is of the narrow type but symmetrical. The back is straight, good range of movements, no muscle spasm. Several nævi are scattered over the chest. There is a normal apex beat in the fifth interspace. All other signs referable to heart and lungs are normal. The abdomen is negative in all respects. The extremities are negative. The blood pressure is 110-78. Larynx examination shows the left cord wider than right, with a tendency to lag a bit. The nervous system shows no signs of abnormality, except those symptoms already noted as referable to a compromised cervical sympathetic. X-ray examination was negative. There was no evidence of intrathoracic goiter, and the first examination of the plates failed to show any shadow cast by the thyroid. After operation had disclosed bone in the gland, the X-ray plates were re-examined and it was found that we had overlooked a shadow cast by the gland, due to the fact that this shadow had superimposed upon it the shadow of the left clavicle. Blood, urine and Wassermann examinations were all negative.

Operation. Under gas-oxygen-ether anæsthesia, a typical hemithyroidectomy was done without difficulty of any kind. The removed lobe was 6.5 centimeters wide, 5 centimeters long, and 4 centimeters thick. During the procedure of mobilizing the lobe, it was recognized that the anterior portion was made up of typical adenomatous thyroid tissue, fairly soft in consistency and with a nodular surface, and that the whole posterior portion of the lobe was stony hard and bone like. After the removal of the

[1]From the Surgical Service of the Jewish Hospital of St. Louis.

Fig. 1. Semidiagrammatic drawing of field of operation, showing the ossified portion of the thyroid growing behind the carotid and pressing upon the sympathetic.

lobe, it was readily seen that this hard substance was really a mass of bone, triangular in outline and that it had crowded the carotid artery somewhat externally, growing under the vessel and pressing with its sharp bony edge against the cervical sympathetic nerve. No visible break in the continuity of the cervical sympathetic nerve could be made out. Figure 1 is a semi-diagrammatic representation of the field of operation. Figure 2 is a photograph of the anterior surface of the removed lobe. Figure 3 is a roentgenogram of the removed lobe, taken in the anteroposterior direction, showing

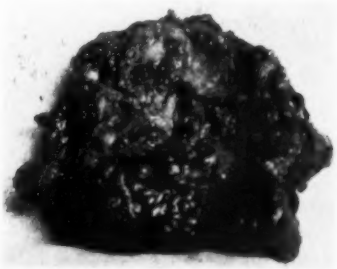

Fig. 2. Photograph of anterior aspect of removed lobe.

the bone distribution in this plane. Figure 4 is also a roentgenogram, taken in the lateral plane and showing the bone distribution in this plane. This last picture shows very well that almost the entire posterior portion of the gland is made up of bone.

A microscopic examination showed that the anterior portion of the lobe was made up of simple adenomatous thyroid tissue and that the posterior portion was made up of primitive new bone. Figure 5 is a photomicrograph of 5 diameters magnification, showing a heavy bone septum with a thyroid lobule on each side of it. Figure 6 is a higher magnification (80 diameters) of the bone formation, showing a primitive haversian canal.

Postoperative course. The patient made an unusually smooth recovery, rested for a few weeks after operation, and then returned to his work. In the course of a couple of months, he was at hard labor, in excellent health and spirits and had regained all the weight that had been lost. The enophthalmos, myosis, hypotonia of the globe and ptosis had not improved when the patient was last seen, several weeks after operation

Recapitulation. Here then we have the history of a definitely compromising asthenia, running hand in hand with a disabling vertigo, a pronounced Horner's syndrome (enophthalmos, myosis, hypo-

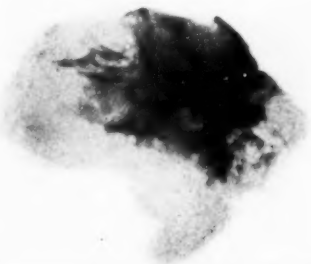

Fig. 3. Roentgenogram of the removed lobe in the anteroposterior plane.

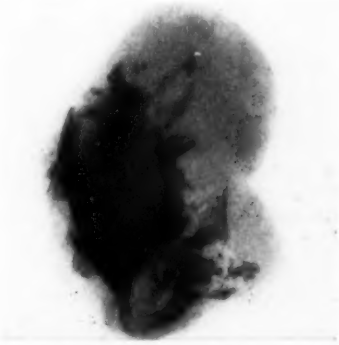

Fig. 4. Roentgenogram in lateral plane to show extent of bone deposit in posterior portion of lobe.

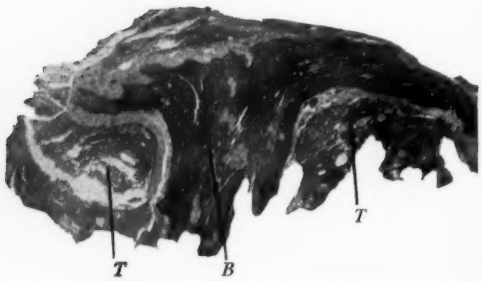

Fig. 5. To show bone formation of thyroid tissue. (x5.)
T, Thyroid lobule; *B*, bone.

tonia, and ptosis) and an enlarged thyroid lobe, in an individual who had lost markedly in weight and strength. In spite of the fact that the symptom complex[1] strongly suggested either a malignant tumor of the thyroid or a cerebral lesion of grave nature, nothing could be made out on physical examination to corroborate such suspicions. The operation and the postoperative course confirmed the negative physical examination, as far as grave or malignant disease was concerned. The compromise of the cervical sympathetic by the sharp edge of the bone tumor easily explains all the eye symptoms, but there is no satisfactory explanation of the marked improvement in health, strength, and weight, following an operation that after all, consisted only in the removal of a simple adenomatous and partially ossified thyroid lobe.

A survey of the literature of the thyroid emphasizes the rarity with which ossification occurs. One author, Sehrt (8) says that the ossification is quite common and that of 28 cases of goiter operated upon in the course of 3 months, 5 showed ossification with demonstrable osteoblasts and marrow. Hunziger and Pfister (2) make a similar statement. These are the only statements of the kind that I have been able to find. Opposed to them is the fact that Ziegler (10), in his text book of pathology, says that ossification of the thyroid (*struma ossea*) is very rarely encountered. Furthermore, I have been able to find only 1 case report and that a very meager one, by Willy Meyer (5), describing ossification of the thyroid. Pennell (7) described a solid tumor of the thyroid, of stony hardness, causing vocal cord paralysis,

[1] Horner in 1869, described the syndrome that now carries his name. He showed that enophthalmos, myosis, ptosis, and hypotonia occurring together, were referable to a compromise of the cervical sympathetic. Since Horner's time other investigators have shown that the syndrome may be caused also by disease of the optic thalamus and that it may develop in cases of central paraplegia. See "Paralysis of the Oculo Pupillary Sympathetic," J. G. Raeder, Brain, 1924, xlvii, 149.

Fig. 6. To show haversian canal formation. (x80.)

and Bell (1) described a similar tumor, causing œsophageal obstruction; but in both these instances, the tumors were calcareous and not osseous. In Bell's case, the cortex of the calcified mass was ossified. Doubtlessly, scattered areas of ossification in the thyroid are more often present than is commonly supposed, but I can find no reason to believe that massive ossification, such as our patient presented, is any other than a rare condition. Wells (9) believes that "there seems to be no essential differences between the processes involved in normal ossification and in most instances of pathological calcification. Calcium salts seem to exert a specific influence on connective tissue cells, causing them to form bone." On the basis of such a statement we naturally expect to find scattered areas of microscopic and small foci of macroscopic bone in the thyroid, because calcification occurs very commonly in the thyroid.

Pathologists are not in perfect agreement regarding the basic cause underlying pathological calcification and subsequent ossification. Wells, in his paper already mentioned, says that 'calcium deposition seems to depend, alike in normal and in most pathological conditions, rather on physicochemical processes, than on chemical reactions," and

Moschcowitz (6) seems in large measure to agree with this view in his statement that "the development of new blood vessels affords the keynote to the interpretation in terms of cellular ontogeny, of the process of ossification." Other authors ascribe to other causes the agency underlying pathological calcification and ossification.

On one point there is practical agreement, namely, that pathological calcification and subsequent ossification may occur in any tissue[1], provided the tissue is dead or that its vitality has been reduced to a sufficient degree. This fact is of particular importance in relation to the thyroid, for it emphasizes one phase of thyroid disease which we, as surgeons, seldom encounter, but which should concern us more than it does now. I refer to the frequent occurrence of thyroiditis. We are accustomed to think of thyroiditis as an acute inflammation of the thyroid gland, more or less menacing in nature, and sometimes ending in suppuration. As a matter of fact, thyroiditis is very frequently unrecognized, and runs its course with so few manifestations of acute symptoms as not to arouse the suspicions of the attending physician. Kocher (4) says that this type of thyroiditis may be caused by chemical poisons or by bacteria and their toxins. The diseases which most commonly involve the thyroid are typhoid fever, measles, diphtheria, scarlet fever, erysipelas, influenza, cholera, malaria, articular rheumatism, parotitis, angina, pneumonia, and enteritis. Kocher says further that this type of thyroiditis has practically no clinical significance except in so far as it leads to functional alteration of the gland. Kaufmann (3) emphasizes this same point and quotes De Quervain and his pupils to the effect that in general infections there is frequently an accompanying thyroiditis simplex, which consists of a microscopic, non-suppurative inflammation of the thyroid gland. This inflammation is characterized by hyperæmia, fluidification and disappearance of the colloid substance, growth and desquamation of the epithelium, and infiltration of leucocytes and other round cells in the alveoli. Hand in hand with this process goes necrosis. We have already learned that necrotic tissue serves as a center for the deposit of calcium. If thyroiditis simplex is as frequent as the pathologists report it to be, then, it is easy to understand why calcific degeneration occurs so frequently in the thyroid. Why ossification or at all events, why massive ossification does not occur more frequently, is not so readily explained.

[1]Wells says (9) "Even such highly specialized structures as the ganglion cells of the brain may become calcified so completely that there results a perfect cast of the original cell, dendrites, axis cylinder and all."

BIBLIOGRAPHY

1. Bell. Montreal M. J., 1895, xxxiii, 297.
2. Hunziger and Pfister. Ztschr. f. Chir., 1906, lxxxii.
3. Kaufmann, Ed. Lehrb. d. spec. path. Anat., 1911, i, 1911.
4. Kocher, A. Keen's Surgery, iii, 378.
5. Meyer, Willy. Proc. New York Path. Soc., 1917–19, 70.
6. Moschcowitz, E. Johns Hopkins Hosp. Bull., 1916, March, xxvii, 301.
7. Pennell. Lancet, London, 1917, i.
8. Sehrt, E. Centralbl. f. Chir., 1905, No. 13, 337.
9. Wells, H. G. Arch. Int. Med., 1911, June, vii, 721.
10. Ziegler, E. Lehrb. d. spez. Path. u. path. Anat., 1883, p. 488.

PRIMARY PNEUMOCOCCUS PERITONITIS IN CHILDREN

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ONE of the gravest abdominal conditions that may arise in childhood is an infection of the peritoneum by the pneumococcus organism. As a complication of pneumococcus infections elsewhere in the body, involvement of the peritoneum occurs in a small percentage of cases. This is the so-called *secondary* form which results from some evident focus such as pneumonia, tonsillitis, or bronchitis. There is, however, a definite group of cases recognized in surgical literature in which the peritonitis is the only demonstrable lesion. That group, spoken of as the *primary* form, is the one to be considered in this article. Because the portal of infection is not known the condition is often referred to as the idiopathic form. A review of our knowledge in regard to these primary cases together with some facts observed in my cases may lead to an earlier diagnosis and a reduction of the extremely high mortality rate.

One striking factor that has been brought out in all statistics of pneumococcus peritonitis is the tendency of the disease to occur in females. Holt and Howland (7) say that girls are affected three times as often as boys. Barling (2) in 1912 reported 234 cases, of which 172 were in girls, and 62 in boys. Of 33 cases collected by Michaut (15) in 1901, 27 were in girls. More recently, McCartney and Fraser (14) have expressed the opinion that the primary form is found only in girls. They believe that a careful analysis will show that all of the cases reported in boys belong to the secondary form. This opinion was evidently held by Du Parque (16) in 1842 when he described these cases under the title of "The Essential Peritonitis of Young Girls."

Although it cannot be said that the disease is confined to children, the incidence in adults is so extremely small that it may be considered as essentially a disease of childhood. Most of the cases reported have occurred between the ages of 5 and 10 years. Griffith (6) says it has been known to appear congenitally. Klaus (10) reported a case in a 9 weeks old infant. Dudgeon and Sargent (5) have described a fatal case in a boy 7 weeks old. An autopsy failed to reveal any point of entrance for the infection. In relation to the age and sex of these patients, the history of one of my cases is of interest.

Case 1. S. S., a boy, 8 weeks of age, was admitted to the Children's Memorial Hospital, April 10, 1922. The parents stated that the child had been well until 2 weeks previously when it was suddenly weaned. Since then it had lost weight and had not been so jolly. Nothing else had been noticed until the day before admission when the baby became suddenly ill with fever, drowsiness, and some difficulty in breathing.

Examination. The child was a well developed but poorly nourished infant baby boy. He was apathetic and appeared to be quite toxic. Breathing was thoracic and somewhat embarrassed. The skin was sallow. Nothing abnormal was found on examination of the nose, throat, heart, and lungs. The abdomen was greatly distended and tympanitic except for an area of dulness below the umbilicus. No masses were palpable; no peristaltic waves were visible; no signs of fluid could be elicited. Rectal examination was negative. The scrotum was rather large and œdematous.

A few hours after admission the child began to spit up a very small amount of greenish fluid. An hour later, following a feeding of albumin milk and water, the baby vomited a large amount of deep green fluid with a distinctly fæcal odor. The stomach tube was passed and about 150 cubic centimeters of this fæcal fluid was removed. A little blood stained mucus was obtained following an enema but no gas or solid material. The temperature was 103 degrees F., pulse 155, and white blood corpuscles 28,750. A diagnosis was made of acute ileus due to peritonitis and an immediate operation was advised.

Operation. Under ether anæsthesia the abdomen was opened by a right rectus incision. When the peritoneum was incised a large amount of green odorless pus exuded. The intestinal coils were everywhere red and injected and covered with large plaques of easily detached fibrin. As the appendix was partially covered by fibrin and appeared to be slightly inflamed, it was removed. A cigarette drain was inserted and the abdomen closed with catgut and skin silk.

Subsequent course. Water was given subcutaneously and by rectum in large amounts immediately after operation. Some vomiting continued during the first 24 hours but none after that. On the second day after operation the bowels began to move and

the abdominal tympany disappeared. The baby took food readily when the vomiting ceased and his general condition improved daily. Convalescence was slow and prolonged somewhat by an attack of acute coryza, but 50 days after operation the wound was healed and the child went home in good condition. Bacteriological examination of the specimen of pus taken at the time of operation showed a pneumococcus in pure culture. Histological sections of the appendix failed to show any pathological changes.

The possible influence of bad hygiene is suggested by McCartney and Fraser. They point out that most of these cases have been found in charitable hospitals among patients whose home environment is not of the best. Griffith, along this same line, believes that alcohol and heredity play a part in the etiology.

Because of the frequent presence of diarrhœa, Annand and Bowen (1), Bryant (3), and others think that preceding attacks of indigestion permit involvement of the peritoneum.

PATHOLOGY

The changes that occur are limited almost entirely to the abdomen. Most authors agree that the disease may be present either as a diffuse or a localized peritonitis. In the diffuse form the abdomen is filled with a green odorless pus containing numerous fibrin clots. The peritoneum is everywhere red and injected and covered in places by plaques of lightly adherent green fibrin. The changes are most marked in the lower half of the abdomen. The localized form is characterized by a well walled off abscess cavity filled with the same green odorless pus and lined with greenish fibrin. The abscess is usually located in or near the pelvis to the right or left of the median line. As the abscess increases in size it tends to point at the place of least resistance, which is usually the navel. Here it may bulge or even rupture spontaneously.

Michaut believes that the diffuse form is caused by a virulent strain of the pneumococcus and the encysted form by an attenuated type of the same organism. Cameron (4), however, regards the diffuse form as merely an early stage of the encysted form and not a distinct pathological type. Kahn (9) agrees with this viewpoint and says the pathological picture develops in a somewhat analogous way to empyema. Aside from the changes in the peritoneum, the abdominal organs show no pathology. Also, in this primary form of pneumococcus peritonitis that we are considering, the lungs, pleura, upper respiratory tract and in fact all other parts of the body appear to be normal. The lesion then is confined to the peritoneum; and that brings up the interesting question discussed in the literature, as to what is the portal of infection in these so-called idiopathic cases.

It is evident that the infection can involve the peritoneum from (1) the blood, (2) the lymph, (3) the gastro-intestinal tract, and (4) the genital organs in the female.

The blood route has been suggested by Koplik (11) as a possibility. Rischbieth (17) who thought that pneumonia was the result of a pneumococcus septicæmia, considered primary pneumococcus peritonitis as actually a secondary process produced by organisms circulating in the blood stream. However, as it is generally recognized today that the infection in pneumonia enters by way of the air passages and that the septicæmia is a secondary condition, it would seem probable that the septicæmia in pneumococcus peritonitis is the result, rather than the cause, of that condition. McCartney and Fraser think that if the peritonitic infection comes from the blood stream, it should be a frequent rather than a rare complication in pneumonia where a septicæmia is always present. This objection, however, is not entirely valid for metapneumonic joint infections are also rare but they are undoubtedly due to infection from the blood stream. That the peritoneum can be infected primarily from the blood stream would seem quite probable from the history of the following case.

CASE 2. L. C., a white girl 3 years of age, was admitted to the Children's Memorial Hospital, on April 14, 1922. Her mother stated that 8 days before admission the child had awakened at 2 a.m. crying and complaining of severe abdominal pain and cramps. Hot applications on the abdomen gave only slight relief. The next day the child began to vomit. An enema was given with good results but the pain and vomiting continued. On the third day the abdomen became distended and the following day a soap suds enema was given which resulted in a stool which contained about a half cup of blood. This

relieved the distention somewhat but the pain and vomiting persisted. There was one bowel movement daily for the next 4 days but every stool contained 2 to 4 ounces of blood. The vomiting, which was mucous for the first 5 days became yellow on the sixth day and had a fæcal odor. On the day of admission it became chocolate colored. Fever had been present with marked fluctuations throughout the course of the illness.

Prodromes. The patient and all of her family had been sick for two weeks prior to the onset of the present trouble with sore throat associated with swollen glands in the neck. This condition was subsiding when the patient was seized with the attack of abdominal pain.

Physical examination. The patient was a fairly well nourished white girl, about 3 years of age, who was acutely ill. She lay rather quietly but cried out when the abdomen was touched. There was an occasional emesis of chocolate colored, watery fluid. Her skin felt dry and the child was markedly dehydrated. The face was drawn and had a worried appearance. The mouth and teeth were dry; the tongue was covered with a dried reddish débris. The throat was moderately reddened. The heart and lungs were normal. The abdomen was symmetrical and moderately distended so that the underlying viscera could not be palpated. No evidences of peristaltic movements were visible on the abdominal wall. On palpation there was a slight muscle rigidity noticeable all over the abdomen, giving a somewhat doughy sensation when pressed upon. A moderate degree of tenderness could be elicited all over the abdominal surface. Rectal examination was negative. The temperature was 100.4 degrees F., respiration, 28; pulse, 180; white blood corpuscles 14,600. Microscopic examination of the stools revealed frequent clumps of pus cells. Only a very small amount of mucous chocolate colored fluid could be obtained when stomach tube was inserted and the procedure did not relieve the abdominal distention.

Pre-operative diagnosis. The history of a throat infection followed by bloody stools and vomiting of a nonobstructive type together with the picture of sepsis pointed to a diagnosis of ileocolitis. However, the abdominal tenderness, rigidity and distention suggested very strongly the presence of a generalized peritonitis, probably secondary to the ileocolitis. Under this diagnosis, operation was advised and accepted.

Operation. Under ether anæsthesia the abdomen was opened by a midline incision. When the peritoneum was incised a green odorless pus exuded from the abdominal cavity. The intestinal coils were everywhere dark red in color and distended. All the abdominal viscera were bathed in green pus and plaques of fibrin were adherent to the intestines in many places. The appendix was somewhat injected and partially covered by fibrin, and therefore it was amputated. A cigarette drain was placed in the pelvis and another in the right flank. The abdomen was closed with catgut and skin silk.

Laboratory findings. Cultures of the pus found in the abdominal cavity showed a pneumococcus in almost pure culture. Microscopic sections of the appendix did not show any pathological changes.

Subsequent course. The first two days after operation were rather stormy but the child was supported by salt solution given at frequent intervals by hypodermoclysis. She was kept at rest in a Fowler position by small doses of morphine. Vomiting ceased the second day after operation and the bowels began to move the following day. Abdominal distention now lessened and the patient took a small amount of food. The general condition of the child improved steadily. The wound continued to discharge until about June 1, 1922, when it was almost healed and the patient was discharged.

In this particular case, we do not know the causative organism in the throat infection. If it was the pneumococcus, this case should probably be considered as belonging to the secondary type. In any event, it does seem to indicate that the peritoneum became infected by way of the blood stream. When we consider how frequently minor nose and throat infections occur in children and pass almost unnoticed, it is not unreasonable to think that the blood stream might carry infection to the peritoneum. It is possible and it seems highly probable that some, at least, of these so-called primary cases occur by this route.

The lymphatic route has been suggested because of the very common lymphatic involvement in upper respiratory tract infections. The greatest objection to this route is the anatomical fact that lymph drainage from the neck does not flow downward as far as the peritoneum but enters the blood stream at a much higher level. To reach the peritoneum the infection would have to travel down retroperitoneally or through the mediastinum. We have no evidence pointing to either of these paths and it is highly improbable that they are ever involved in primary pneumococcus infections of the peritoneum.

The gastro-intestinal route is naturally thought of because of the frequency of such irritative symptoms as vomiting and diarrhœa. Annand and Bowen say that the frequency of diarrhœa and pain at the onset is very suggestive of enteritis passing on to peritonitis. The occasional presence of the pneumococcus in the intestinal flora and the finding of the organism as noted by Stoos (18)

in the subperitoneal tissue of the intestinal wall in cases of pneumococcus peritonitis have seemed to point rather strongly toward an intestinal invasion. It should be noted, however, that the pneumococcus has not been found in the bowel wall except in cases in which the peritoneum has been infected, so that McCartney and Fraser aptly state that they think the intestinal wall was invaded from the peritoneum rather than vice versa. These authors repeated some unsuccessful experiments of Jensen's (8) in which rabbits were fed virulent cultures of pneumococci in an attempt to produce peritonitis, but the results were negative. McCartney and Fraser point out that there is no demonstrable lesion of the mucosa, although such a lesion should be present necessarily if the infection passed through the mucosa from the bowel to the peritoneum. However, it might be assumed in these cases when we have a diarrhœa and an enteritis that such a lesion is present and demonstrable.

The female genital tract. It is a well established fact in gynecological pathology that the peritoneum can be invaded by infection from without by extension from the fallopian tubes. Tuberculosis and gonorrhœal infections of the peritoneum are known to enter by this route. McCartney and Fraser argue very strongly in favor of this avenue of infection. They state that the process begins as a pelvic peritonitis which either spreads or localizes. Other observers have noted the frequency with which the process is confined to the pelvis and lower abdomen. Very logically, McCartney and Fraser point out that, if the infection occurs by the genital route in primary pneumococcus peritonitis, the disease must be limited to females. This, they believe, is actually the case, for after reviewing a series of 56 cases of pneumococcus peritonitis they found 36 that they considered primary, and all of these occurred in girls. Furthermore, they claim that these primary cases occur only in girls of the poorer classes who are subjects of poor hygiene. From girls of that kind they have found pneumococcus organisms in the vaginal smears. To substantiate their beliefs they took cultures from the throat, the blood, the vagina, and the upper and lower parts of the peritoneal cavity in 10 cases. In every case they isolated a pneumococcus of the same type from the vagina, blood, and peritoneal exudate. Cultures from the throat also showed the pneumococcus but in one case the organism was of a different type than that found in the abdomen. They also found that cultures from the upper abdomen were very light or were negative while those from the pelvis were very heavy. This would seem to point to an infection beginning in the pelvis. If we sum it all up there can be little doubt, from all the evidence gathered by McCartney and Fraser, that in many cases of primary pneumococcus peritonitis the infection enters by way of the female genital tract.

However, that only girls are affected is doubtful for I have reported a primary case in an 8 weeks old boy and other observers have seen this condition in males. In such cases the infection must have gained entrance by the blood stream or the gastro-intestinal tract.

The clinical picture presented by these cases of primary pneumococcus peritonitis differs somewhat according to the underlying pathology. Michaut, in 1901, described the symptoms as seen in the circumscribed form, in three phases. The onset, which he calls the meteoric phase, begins with a sudden attack of acute pain, that soon spreads over the entire abdomen; vomiting that is profuse and persistent; diarrhœa, which may show bloody stools, and fever. This phase passes to a more chronic condition after a week or 10 days and becomes encysted with abscess formation. The fever, which has been rather high, begins to moderate, the vomiting lessens or disappears. Examination of the abdomen shows signs of abscess formation usually below the umbilicus and lateral to the median line. This condition is spoken of by Lennander as abdominal empyema. If not relieved by surgery the condition will pass on to the perforative phase in which evacuation of the abscess occurs spontaneously, by rupturing at the navel in the vast majority of cases. In rare instances perforation may occur into the bowel, vagina, or bladder.

The diffuse form of primary pneumococcus peritonitis is a more serious picture. The onset is sudden with high fever, intense ab-

dominal pain, rapid prostration, copious diarrhœa, and persistent vomiting. This is soon followed by delirium, sordes, typical facies, cyanosis and cold extremities, and in many instances early death. Abdominal examination shows a singular absence of localized tenderness or rigidity. There is some distention present, either generalized or localized, usually below the umbilicus. There is a peculiar doughy feeling of the abdomen in many cases, described by Parker Syms (19) and Marshall (13). It was present in the 2 cases described here.

The diagnosis is rarely made in the diffuse form before the abdomen is opened. It should be thought of in those acute abdominal conditions, especially in girls, which show a sudden onset with great prostration, severe toxæmia, marked nausea and vomiting, with a striking absence of localized pain, muscle spasm, and tenderness but with some tympanites and rigidity.

The localized form is more readily diagnosed because of its more gradual onset with the increasing signs of abscess formation in the lower abdomen pointing toward the navel. Von Brunn (20) believes that the spontaneous rupture at the umbilicus in these cases is pathognomonic of primary pneumococcus peritonitis. In cases in which the abdomen is opened the finding of green odorless pus containing flakes of fibrin is regarded by Woolsey (21) and Parker Syms, as definitely characteristic. Syms believes that many cases of streptococcus peritonitis are possibly of pneumococcus origin. Unless careful bacteriological tests are made this mistake will occur.

Differential diagnosis. This condition lacks the localized tenderness and rigidity of appendicitis. The diarrhœa is also in contrast to the usual constipation of appendix disease. The marked tenderness and rigidity present in cases of peritonitis due to a ruptured viscus is quite different from the mild abdominal signs found in pneumococcus cases where it is noticeable how much sicker the patient seems than the abdominal examination indicates. Typhoid fever has a leucopenia instead of the high leucocytosis of pneumococcus peritonitis. Also, in typhoid fever, there is a history of the onset of fever preceding the pain, whereas pain is the initial symptom in the pneumococcus patients. Tuberculous peritonitis resembles the localized form of pneumococcus peritonitis but it has not the history of an acute sudden onset and it runs a much slower course. However, some of the milder localized cases have an insidious onset that may present a very baffling resemblance to tuberculous peritonitis.

Generalized peritonitis is always a very serious condition especially in children. In primary pneumococcus peritonitis the earlier writers have reported a mortality of 80 per cent or more. They advise against operation except in the milder cases when an encysted collection of pus can be drained. Parker Syms believes that operation is always fatal in the diffuse form and should not be performed unless a localized abscess forms. He says this is the only exception to the rule of immediate operation in generalized peritonitis. Kahn, who believes that the diffuse form is only an early stage of the encysted form, advises supportive treatment until a definite abscess develops. Lilienthal (12) thinks that this disease like gonococcus peritonitis should never be treated by operation.

On the other hand, Fraser and McCartney are strongly in favor of immediate operation under gas, to establish drainage. They report a mortality of 53 per cent which, although high, is a marked improvement over the earlier statistics. More recently they have been using blood transfusions in addition to the operative treatment and their mortality is down to 42 per cent.

There is probably a rather general idea among surgeons that the encysted cases should be watched until they are well localized. They may then be drained with a fair degree of safety. In the diffuse form the problem is more difficult. It is true, no doubt, as Kahn has stated, that we cannot drain the peritoneal cavity by any operative precedure. There is, however, in these cases a certain amount of intra-abdominal pressure that tends to increase the absorption of toxins by the peritoneum. This intra-abdominal tension can be relieved by a simple opening of the abdomen and the insertion of drainage. The operation should be as brief and non-traumatic as pos-

sible. The patient should then be put to bed in the Fowler position and kept at rest with morphine. Plenty of water must be given by rectal drip or subcutaneously. Hot packs may be used on the abdomen if they do not disturb the patient. In the diffuse form of primary pneumococcus peritonitis this combination of immediate simple operation, absolute rest, and strong supportive treatment has given us more favorable results than the supportive treatment alone. Under the latter only too many patients die unfortunately before any localization can take place. The operative treatment would seem to give them a somewhat better fighting chance.

REFERENCES

1. ANNAND and BOWEN. Lancet, 1906, June.
2. BARLING. Practitioner, 1912, lxxxviii, 537.
3. BRYANT, J. H. Brit. M. J., 1901, ii, 767.
4. CAMERON, H. C. Proc. Roy. Soc. Med. (Clin. Sect.), v, 123.
5. DUDGEON and SARGENT. Lancet, 1905, March 4, 548; 1914, December 12.
6. GRIFFITH. Diseases of Infancy and Childhood. 2d ed., p. 515; 1919; 1st ed., p. 845. Philadelphia: W. B. Saunders and Company.
7. HOLT and HOWLAND. Textbook. Diseases of Infancy and Childhood. New York: D. Appleton and Company, 1922.
8. JENSEN. Arch. f. klin. Chir., 1903, lxx.
9. KAHN, L. N. New York M. J., c, 1166.
10. KLAUS. Cited by Griffith (6).
11. KOPLIK. Diseases of Infancy and Childhood, 3d ed., 572. New York: Lea Bros., 1910.
12. LILIENTHAL. Ann. Surg., 1918, lxvii, 248.
13. MARSHALL, V. F. Illinois M. J., 1921, xxxix, 481.
14. McCARTNEY and FRASER. Brit. J. Surg., 1921–22, ix, 479; FRASER, Brit. M. J., 1922, i, 176.
15. MICHAUT. Gaz. d. hôp., 1901, lxxiv, 361.
16. PFANNDLER and SCHLOSSMAN. Diseases of Children. 3d ed., p. 252. Philadelphia: J. B. Lippincott and Company, 1912.
17. RISCHBIETH. Quart. J. M., 1910–11, iv, 205.
18. STOOS. Jahrb. f. Kinderh., 1902, 573.
19. SYMS, PARKER. Ann. Surg., 1918, lxvii, 263.
20. VON BRUNN. Beitr. f. klin. Chir., 1903, xxxix, 70.
21. WOOLSEY. Ann. Surg., 1918, lxvii, 248.

A CLINICAL SURVEY OF THIRTY CASES OF PROVED TUBERCULOSIS OF THE PLEURA[1]

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In man's attempt to withstand the onslaughts of various types of injury during the course of life, there has been developed a protective mechanism that operates with more or less efficiency so that he has been able to ward off the phenomenon that we know as disease. All such phenomena are due to some sort of injury and call forth from the body certain responses, of which inflammation is an important one. Associated with these reflex phenomena of vascular and cellular changes incident to injury is the production of immunity, which enables future traumatisms of similar type to be met without danger, and the more immediate process of repair, which permits tissues attacked again to assume their normal function.

As a subclass of inflammation is the process of chemiotaxis, by which certain cellular elements are attracted or repelled by the noxious agent itself or by its products. In the pleura, these responses occur as in all other tissues, and the nature of the changes corresponds to the extent of injury, to the chemiotactic action on cells, to the broadening of the vessels so that fluid materials may be poured out, to the ability of the noxious agent to withstand the attack made on it, and finally, to the ability of the body to clear away the débris and repair damaged tissue.

It is quite important then to recognize that various results will follow the intervention of the same irritant, depending on the amount of damage to tissue, the virulence of the noxious agent, and the protective forces employed to combat it. For this reason, we see in the pleura attacked by a single organism evidences of pleuritis that we arbitrarily divide into types known as fibrinous, serofibrinous, hæmorrhagic, and purulent. It would be impossible to segregate these inflammations of the pleura into any really sharply defined groups with either characteristic clinical or pathological pictures.

The material studied in this investigation comprises thirty cases of proved tuberculosis of the pleura, including both primary and secondary forms, as well as those in which both serofibrinous and purulent exudates have existed. In the main, these patients have shown evidences of primary disease of the pleura, but one must realize that the supposedly primary disease, such as primary disease of the peritoneum, may really be a secondary condition, the primary one not having been discovered at the time of examination.

In this series, there were twenty-one men and nine women, whose ages varied from 15 to 59 years. In the second decade, there were three patients, in the third fourteen, in the fourth seven, in the fifth two, and in the sixth four. They came from widely separated areas, the Atlantic states being represented by two, the middle west by seven, the south by two, and the southwest by one; twelve states in all, while two foreign countries were represented and two patients were wanderers without definite location. In so widespread a disease as tuberculosis, this wide distribution is quite to be expected. Tuberculosis is a disease which affects all people, regardless of location, race, or occupation. Twelve definite occupational groups were represented in the series:

Farmers	8	Stenographer	1
Housewives	5	Insurance agent	1
Students and teachers	5	Electrical engineer	1
Oil-field workers	2	Brakeman	1
Laborers	2	Banker	1
Miners and granite workers	2	No occupation	1

At examination, the complaints were various, but 50 per cent of the patients came because of sinuses persisting after operations on their chests. These sinuses had existed for from 2 months to 19 years.

Six of the patients had reported that they were first ill with influenza. This has become

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a common report by patients with all types of sickness, probably because following the epidemic of 1918 many minor troubles were ascribed to influenza. The patients became weak, having fever that ranged from 100 to 101 degrees, but of irregular type, they were often fatigued easily and had anorexia and more or less indefinite pain in the chest, although it was sometimes referred to the abdomen. Cough developed and was productive of sputum that was described as slight, moderate, or profuse, and in two instances, as malodorous. Influenza may have been the forerunner of the illness in a few cases, but it attacked so many persons that symptoms were familiar and a diagnosis was often made by the patient rather than by physicians, so that it is doubtful whether influenza in itself was the precursor of the disease.

In eighteen of the thirty cases, the history of illness was so insidious that it was reasonable to believe that the infection was tuberculous from the beginning. In fourteen cases, the onset was definitely characteristic of pleurisy. Some of the patients complained of soreness throughout the chest and later developed pain on inspiration, but others had sudden, knife-like, agonizing pains increased by inspiration and by coughing. One patient reported that the chest became immobile and enlarged before a diagnosis of fluid collection was made, and one patient suffered from aphonia. This was the only instance of pressure phenomena recorded. Others may have had circulatory changes such as cyanosis, venous engorgement, or tachycardia.

However, fluid had been found at the first thoracentesis in eighteen instances; it was serous in eleven instances, and turbid or purulent in seven. From the descriptions given, there would seem to be no question concerning the serous character of the fluid, whereas there might be some doubt about a report of purulent exudate, because when such a report was made the disease had been of such long duration that a description of the original material removed could not be accepted as entirely accurate. The number of serous effusions was probably greater than that reported while the number of purulent effusions was probably less.

Many operations had been performed before examination at the Clinic; these had included rib resection, tube drainage and aspiration. Fifteen patients had had rib resections, an average of 11 months before examination, the shortest time being 2 months and the longest 24 months before. In two other cases rib resection had been done 6 years, and 19 years before, respectively. One patient had had a drainage of undescribed character 4 months previously, seven had been aspirated an average of 11 months previously, and two had had no operation but they had been ill on an average of 7 months, ranging from 1 to 24 months.

There were twenty-five patients who had histories negative for tuberculosis in their families, one patient had had a sister with tuberculosis, one a grandmother, one both a sister and a brother, and two did not know the family history. One would conclude that so far as this series is concerned, no relationship existed between the illness of the patient and any hereditary tendency.

APPEARANCE

Patients ill so long and with such a chronic and debilitating disease would necessarily show evidence of their illness in their general appearance. Eight of the patients looked decidedly ill, eight poorly nourished, five slightly undernourished, four well-nourished, six anæmic, and five extremely weak.

Loss in weight, as in all other chronic debilitating diseases, was apparent. There was a minimal loss of 1.5 pounds or 1.8 per cent of the normal weight, a maximal of 49 pounds or 28 per cent, and an average of 18.3 pounds or 12.3 per cent. One patient had gained weight, three had maintained their normal weight, and a record of the weight was not obtained from three.

BLOOD PRESSURE

The average blood pressure was somewhat lower than normal. The highest blood pressure was 144 systolic and 84 diastolic, the lowest 98 systolic and 74 diastolic, and the average 117 systolic and 77 diastolic. This is in accordance with the average blood pressure readings in diseases of this type, and corre-

sponds fairly closely with the blood pressure in cases of tuberculosis elsewhere in the body.

CLINICAL FINDINGS

The pulse rate was elevated, the highest being 130 each minute, the lowest 72, and the average 103. Temperature also showed a similar elevation, ranging from 103 to 97 degrees, the average being 99.4 degrees.

Examinations of the sputum were positive in the two cases in which the pleurisy could be definitely considered a secondary disease.

THE CLINICAL DIAGNOSES ON PRIMARY EXAMINATION

	Cases
Chronic empyema	23
Pyopneumothorax	3
Tuberculosis (?)	16
Osteomyelitis	1
Empyema with insufficient drainage	2
Empyema with bronchial fistula	1
Pleural effusion, unclassified	6
Empyema with infected sinus	4
Abscess of the lung	1
Pneumoconiosis	1

CONDITIONS INDICATIVE OF TUBERCULOSIS

One patient had had cough and expectoration 7 years and had previously been treated for tuberculosis. He then had repeated attacks of minor infections that simulated influenza, with fever, chills, pain in the chest, slight cough, slight expectoration, and frequent night sweats. He was in bed for several months.

A second patient had repeated attacks of sudden and abrupt illness for 2 years previous to coming to the Clinic; with each attack pains in the chest increased on breathing, followed by a long and tedious convalescence.

A third patient had an illness with a very slow, insidious onset with malaise, weakness, cough, expectoration, and a history of having had eleven aspirations for removal of straw-colored fluid 10 years before.

A fourth patient had an abrupt onset of pleurisy, characterized by knife-like pains, fever of 103 degrees and a voluntarily controlled cough. There was a prolonged convalescence, with weakness following fullness in the chest. Three months previous to admission he had had a definite pulmonary hæmorrhage of 4 ounces of blood.

A fifth patient had an abrupt illness with a long convalescence characterized by general malaise for 2 months. Two months later, there was a definite history of pleurisy, and his home physician made a diagnosis of tuberculosis.

A sixth patient had an illness the onset of which was said to be due to grippe, but was really characterized by malaise, loss of weight, night sweats, and a soreness in the side, which soon developed to definite pleuritic pains. One sputum examination was reported as positive for the bacillus of tuberculosis. This patient was the only one who developed aphonia. The latter seems to have been associated with the complete collapse of the left lung which was revealed on physical examination.

A seventh patient had a sudden onset of illness with what was diagnosed as pneumonia 15 months previous to admission, followed by a very slow convalescence, gradual onset of cough, and then increasingly productive sputum. He had vague chest pains for 2 months before a sense of fullness in the chest appeared. Air was obtained on aspiration. Asymptomatic spontaneous pneumothorax was diagnosed.

An eighth patient 2 years before admission had general malaise with weakness, fever, headache, cough, sputum, night sweats, continuous illness, and a history of a gradual accumulation of serous fluid in the chest. He had had no pain in the chest.

A ninth patient had an onset with pain in the chest increased by inspiration, shortness of breath, non-productive cough, fever, and findings of clear fluid.

A tenth patient had an insidious onset, 1 year before admission, of malaise, and cough, irritating but non-productive. He had been ill for 3 months before sputum appeared, and had developed dyspnœa on exertion.

An eleventh patient had suffered from general malaise with loss of vitality and appetite. His capacity for work was decreased, and production of malodorous sputum with the cough gradually increased until there was as much as 8 ounces at a time. The patient became markedly dyspnœic, had palpitation, and symptoms suggestive of spontaneous pneumothorax.

A twelfth patient, 2 months before admission, had low-grade fever, continuous persistent weakness, and shortness of breath.

A thirteenth patient, a year previous to admission had general malaise with weakness, loss of appetite, and loss of strength. Fluid was found early; six aspirations each produced a quart of fluid; the last one was made 5 months before examination. The temperature ranged from 99 to 101 degrees. Shortness of breath was relieved by each aspiration.

A fourteenth patient was a young woman, who, after her first pregnancy, developed fever without evidence of infection in the pelvis. During her slow convalescence she had definite sharp pains in the chest which increased on breathing. Clear fluid was obtained 3 weeks after onset, by tapping.

A fifteenth patient had a long illness with cough persisting for months, which was productive of sputum sometimes containing blood streaks.

A sixteenth patient, known previously to have pulmonary tuberculosis, had an insidious onset of fever, developed mild pleuritic pains, later becoming sharp, and evidence of serous fluid collecting gradually. This case was observed from the onset.

TYPES OF SYMPTOMS

In reviewing the symptoms in the histories in these cases it is noticed that the cases fall naturally into three groups, according to their symptoms:

First and most typical are the cases in which there is an insidious onset of general malaise, including slight fever from 99 to 101 degrees, weakness, easy fatigability, nervousness, cough, and indefinite pains in the chest, either remaining as such or developing into acute stabbing pains associated with increased severity on inspiration. The pain in this type of case usually lessens with gradually increasing amounts of fluid. The dyspnœa depends entirely on the rapidity with which the fluid collects. A few patients have reported on examination that they were able to do severe athletic exercise a few days before admission, at which time one side of the chest was found to be completely filled with fluid and the mediastinum markedly displaced. In those in whom the chest filled rapidly with fluid, dyspnœa was acute, and in rare instances, tachycardia, aphonia, giddiness, and cyanosis occurred, and in one case, a painful swelling of the arm on the affected side.

It is important to keep in mind the ubiquitous nature of tuberculosis. It, like syphilis, should always be remembered as a diagnostic possibility. Any cough lasting more than 3 weeks is a symptom to be carefully appraised. Fever requires equal discrimination, particularly if the patient has never appeared to have an unstable nervous mechanism. In this group, of course, the longer the fever lasts and remains unassociated with other phenomena, the more likely it is to be due to neurosis alone and not to tuberculosis. This is an important consideration. Many patients are observed who have had fever for months or even years, who have been classified and treated as tuberculous, yet in whom no evidence of such disease could be found by any means at our disposal. Fever is one of the reactions of the body which should not persist singly for a prolonged period.

The second group of cases comprises those in which the patients are acutely ill from the onset, and in some of which chills have been the initial symptom. The latter, however, is an unusual finding in tuberculosis, and ordinarily would be a contra-indication to a diagnosis of tuberculosis, yet they will appear, first, occasionally at the onset of the disease or, second, if there is a rapid transfer of large numbers of organisms to other portions of the same organ or to distant organs. As a rule, these patients suffer severely with acute pleural pain, and have a higher fever than the first group, as high as 103 and 104 degrees, but at the termination of the acute stage, they commonly take on the same characteristics as in those in whom the onset is more insidious.

The third group comprises patients who have the characteristic onset of pulmonary tuberculosis. They also are likely to have an insidious onset, with malaise, weakness, tachycardia, slight fever, loss of weight, nervousness, and a slight productive cough. Two of the group in whom we suspected tuberculosis, though they came with definite signs of empyema and draining sinuses, had such an onset

and gave a definite history of hæmorrhage of bright red blood in amounts larger than 1 dram, while another had had blood-streaked sputum for a long time. In this instance the productiveness of the cough bore a definite and direct relationship to the duration of the illness.

The fourth group in the series comprises the young women who, following pregnancy, develop an illness with insidious onset similar to that in the preceding group. The illness can not be attributed to the pregnancy itself nor to the type of labor. It is so well known that patients who have had a tuberculous lesion at any time in their lives may develop signs of acute re-involvement following labor. This group is always important, and the onset of such an insidious illness after labor warrants a suspicion of tuberculosis. If a sterile serous effusion is obtained from the pleural cavity, it constitutes evidence for tuberculosis as accurate as a hæmorrhage.

It should be noted that in these four groups were eighteen patients, eleven of whom had had a history of removal of serous effusion. The twelve other members of these groups had histories of illness that could not possibly be construed as tuberculosis; seven of these reported that the material aspirated was purulent in character, though, as noted before, some doubt may exist as to the accuracy of this report. It is quite possible that the description was faulty, in which case the number of serous effusions would be increased. The patients had no knowledge of the cytological characteristics of the removed fluid, its infectious agents or its sterility, the results of animal inoculation, or whether any such tests had been made before drainage and other measures were instituted.

X-RAY DIAGNOSIS

When patients come for examination after having had various types of operation or other interference with the pleura, and often for months or even years, the X-ray can hardly be expected to diagnose accurately the primary or underlying cause of their trouble. The pleura becomes impervious to light, the lung is often fibrosed, and dislocation of the mediastinal organs occurs. In this group, in which the condition ultimately proved to be pleural tuberculosis, empyema was diagnosed in eight instances, increased density in fourteen, fluid alone in fifteen, pneumothorax or pulmonary collapse in six, Pott's disease in one instance, pulmonary tuberculosis in eight instances, while abscess was suspected in two in which large amounts of malodorous sputum were obtained by change of position and cough. In all probability these cases were due to the induration of the lung with fibrosis and the formation of bronchiectatic cavities rather than true abscess. That is, the roentgenogram could yield only the information that the pleura was involved or that fluid was present because the chest was impermeable to the ray. The roentgenogram was extremely important in revealing evidences of tuberculosis in the lungs in eight cases, and of associated tuberculosis in other parts of the body in one case of Pott's disease.

BLOOD COUNTS AND OTHER TESTS

It is somewhat surprising that a greater change was not found in the blood counts in these patients. One would expect that debilitating disease over a long period would have produced a more marked secondary anæmia. The highest hæmoglobin by the Dare method was 89 per cent, the lowest 56 per cent, and the average 76 per cent. These figures are in agreement with those obtained in a survey of cases of tuberculous enteritis, in which the highest hæmoglobin was 85 per cent, the lowest 30 per cent, and the average 65 per cent. The number of erythrocytes likewise was higher than might have been expected, the highest count being 5,650,000, the lowest 2,500,000, and the average 4,350,000. The leucocyte count was interesting; the highest count was 20,800, while the lowest was 5,600, and the average 10,000.

Considering that many of the patients had had serious operations on the chest with inevitable mixed infection, an average of 10,000 leucocytes is not unexpected. One is inclined to believe that a tuberculous infection will not produce a high leucocyte count, and any count under 10,000 naturally suggests the possibility of this disease. However, in

the presence of mixed infections, and most of them of long duration, any rule regarding number or character of cells is lost, and the leucocyte count is not of diagnostic aid. However, in the cases in which operation had not been performed, the blood counts followed the usual rule in tuberculosis and were lower than normal.

Cultures, smears, and guinea-pig inoculations were made in all of the cases from one to eleven times each. From the culture or smear three positive findings were obtained. As my experience with chest cases broadens, the direct smear from sinuses is becoming of increasing importance, and positive diagnoses have been made in a considerable number of cases by this method alone. This method has also been of great value in testing for actinomycosis and even in a very few instances, endamœba histolytica. I believe that such an examination of any draining sinus about the chest, or indeed other regions of the body, is quite necessary.

Guinea pigs were inoculated from materials obtained from the chest, and cultures were positive in nine cases and negative in four. They were not inoculated in a number of instances in which the diagnosis was positive by culture and smear or pathological test. By the latter methods findings were positive in seventeen tests. It is quite possible that negative reports may be obtained in the first examination of tissue, like that of smears or even of guinea-pig inoculations. In the seventeen positive reports on tissue, five of the tissues had at some time been reported as inflammatory before the positive pathological specimen was obtained. Repeated examinations should be made in these tests before making a final report of a negative result, just as in sputum examinations.

LATE REPORTS FROM SURGICAL PATIENTS (1923 TO MARCH, 1925)

The patients on whom we were forced to operate, because of widespread secondary infections, were almost all dismissed with granulating wounds, and either sent home for further treatment, or to sanitariums where their tuberculosis could be more satisfactorily treated. It is rather surprising to find that a large number finally responded to treatment, and to receive reports years later that seven of the patients had been able to return to productive life and were in very good general health. Five were reported in poor condition and unable to work, five have not been heard from, and thirteen have died.

OPERATIONS

No operative procedure other than aspiration was done in cases in which there was serous effusion or sterile turbid effusion, but in cases in which there were draining sinuses and resultant infection, empyema pockets and remarkably thickened pleura sometimes 1.9 centimeters in thickness, various types of operative procedure were necessary, including rib resection, decortication, skin flap operations, resection of sinus tracts, cauterization of fistulæ, and Schede's operation. These operations are for the purpose of assisting the usual phenomena of inflammation, which comprise not only the attempt to discourage or kill the noxious agent and repair the tissue damage, but also the carrying away of the débris (MacCallum). Operation assists especially, in this third phase of inflammation, inasmuch as purulent material cannot be absorbed readily, and one of nature's methods is to allow fibrin to remain in place and to change it into scar tissue. In diseases such as tuberculosis, in which the offending organism does not die but becomes a continuous irritant, large masses of fibrin are laid down layer after layer, ultimately resulting in very dense thickening of the visceral and parietal pleura, leaving a condition which must necessarily be treated surgically because of the mechanical inability of the cavity to collapse. Consequently chronicity is inevitable and permanent, subject to recurrence of acute exacerbation unless thorough surgical interference is instituted.

PREVIOUS WORK

Lord's findings in two types of pleurisy are most important. In the acute fibrinous type, he found that 64.6 per cent of the cases were regarded as primary but agreed that thirty other cases may have been due to exposure and of the *a frigori* type. With regard to the secondary type, he believes that infection with

the bacillus of tuberculosis, particularly in the lung or bronchial lymph glands, may be regarded as the starting point in a large number of cases. He believed that there was pulmonary tuberculosis in 5.2 per cent of eighteen cases; bacilli of tuberculosis being found in the sputum in six cases. In the serofibrinous group, there were 750 cases apparently primary (63.4 per cent of 1,185 cases). Tuberculous serofibrinous pleuritis comprises the largest and most important group, while nontuberculous infections comprise a much smaller group, and other cases, such as transudates on which an inflammatory process has been superimposed, form a still smaller group. In this last group it would seem that cases of serofibrinous pleurisy, such as in Hodgkin's disease and lymphosarcoma, often observed at the Clinic, might be included. Doyle and I were able to demonstrate serous effusion in 30.7 per cent of patients having Hodgkin's disease with mediastinal involvement. In the secondary cases, Lord believed that there was slight or positive evidence of pulmonary tuberculosis in 13.5 per cent of 160 cases. The lung was tuberculous in 149, and 47 had the bacillus of tuberculosis in the sputum. Such data support the belief that a large proportion of cases of serofibrinous effusion, more especially those of the primary type as well as those in which pulmonary tuberculosis is associated, are essentially tuberculous in character. Accordingly all such cases should be considered as tuberculous unless they can be proved otherwise. Such an assumption would have prevented the open and dangerous operations that were productive of empyema in my series of cases. Lord gives several reasons as proof of the correctness of this assumption. He quotes Osler's 195 cases, in 30 of which the bacillus of tuberculosis was found in the sputum. He believes that serofibrinous effusion is one of the most important signs of pulmonary tuberculosis, and that it is a very early manifestation, which is necessarily true because the pleural space becomes obliterated later.

All diseases of the lungs, acute and chronic, may and usually do cause pleural irritation or pleurisy with sufficient inflammatory reaction to be clinically discernible. In apical tuberculous lesions, the pleura is involved early, and thickens with coalescence of parietal and visceral layers. The advancing pleuritis keeps pace with the advance of the lesion in the parenchyma and acts as a protective mechanism without which the accident known as spontaneous pneumothorax would be common rather than comparatively rare. The subsequent history would show that from 35 to 40 per cent of such patients develop manifest pulmonary or other tuberculosis within 6 years. The evidence of the truth of these assertions of Lord may be found in the report of Hedge, Sokolowski, and Bowditch, and in the actuarial figures quoted by Norris and Landis. The postmortem evidence from 131 necropsies in different types of pleuritis examined by Osler, showed that 32 were definitely tuberculous. The tuberculin reaction in these cases is usually positive. He quotes the figures of the Massachusetts General Hospital, there being 36, 76.5 per cent, positive reactions in 47 cases. One may add that Ghon was so sure of the importance of the tuberculin reaction that in every instance in which he was unable to find the primary site of the disease, he made a most careful dissection of the whole body, being confident that the primary site would be discovered if the tuberculin reaction were positive. He thinks that there should be a preponderance of lymphocytes in a large proportion of serofibrinous fluids with primary pleurisy and effusion, but does not believe the cytological formula of Widal is an invariable proof.

HÆMORRHAGIC EFFUSIONS

When hæmorrhagic effusions are found in the chest, one is inclined to believe that either tuberculosis or cancer is present. This is not necessarily true because sometimes, in very acute conditions, hæmorrhagic fluid is found in man, and in experimental animals. Sanguineous fluid was found repeatedly during experimental work on dogs in which the irritant was introduced intratracheally. Since it must be assumed that the majority of pleural effusions are inflammatory it would, therefore, be expected that as an evidence of inflammation and the broadening of the blood channels, erythrocytes would be found in the

effusion. As in the examination of the urine, the findings are divided in two groups, the grossly hæmorrhagic, and the microscopically hæmorrhagic. Dieulafoy found that it requires from 1,500 to 3,000 erythrocytes to each cubic centimeter to make any appreciable alteration in color, and from 5,000 to 6,000 to produce a rosy tinge to the fluid. Naturally, the more erythrocytes there are the more hæmorrhagic the fluid will be. In my experience, definite hæmorrhagic fluids have most often indicated the presence of malignant disease, but tuberculosis, particularly in young patients, must always be suspected because primary tuberculosis is essentially a subpleural infection. The associated vascularity of the part, aided by the varying negative pressure incident to respiration, provides the mechanism for the liberation of erythrocytes and serum into the pleural space. The irritation can easily provide for leakage as a result of the degeneration of the small vessels and the resultant involvement of the vessels by the tuberculous process. Norris and Landis are of the opinion that the condition is similar to hæmoptysis, which is a forerunner of acute tuberculosis.

One interesting finding in hæmorrhagic effusion is in the eosinophilia that occurs sometimes, both in the effusion and in circulating blood. This is a peculiar reaction that sometimes obtains as a result of infections of various kinds. Dieulafoy found 35 per cent of eosinophils in effusion, and 10 per cent in circulating blood, but as high as 76.4 per cent has been found in effusions with 40 per cent in the blood. Approximately eighty such instances have been reported, but I have been able to find only one instance in which the bacillus of tuberculosis was located in the hæmorrhagic fluid.

It is very rare for a sterile exudate of serofibrinous pleurisy to change from serous to purulent. Lord, in his 1,185 cases, observed this change in only 1.3 per cent. In my own experience, it has been even more rare. It is only after interference that such a change is apparent. Purulent conditions, however, are apparent when secondary infection occurs from repeated aspiration, from infections due to open operations, or when the interior of the lung is connected by a fistula with the pleural cavity.

Duboff, in a clinical study of twenty cases of tuberculous empyema, which he defines as a purulent effusion into the pleural cavity caused by the bacillus of tuberculosis, found fourteen pleural effusions in which he was able to demonstrate acid-fast bacilli; two cases were negative, and four were not tested. He believes that tuberculous empyema differs from postpneumonic empyema in the underlying persistent pulmonary tuberculosis which is nearly always present and obvious. Clinically, the process is an extension to the pleura from the lung itself and usually occurs by rupture, although no evidence of communication and no signs of coincident pneumothorax may be found. Often, however, the picture is that of spontaneous pneumothorax with pain, dyspnœa and fever, followed by the effusion, at first serous and then seropurulent. Unlike most observers, Duboff believes that the bacillus of tuberculosis can almost always be found in the purulent effusion, and that mixed infections are uncommon before the stage of fistula formation. He thinks that communication with the bronchi is not absolute evidence of mixed infection, doubting whether pyogenic organisms are found in the small bronchi. He challenges the usual belief that empyema is not an accumulation of pus in the ordinary sense of the word, and that the causative micro-organism is seldom present. He thinks that the bacillus of tuberculosis in the effusion is as common as it is in the sputum of tuberculous patients. In his series one of the most important causes was the rupture of the lung due to artificial pneumothorax, and this in all probability is one of the most common seen by sanitarium workers because in many instances a fibrous caseating lung containing a subpleural cavity subject to the repeated strain of coughing may break down and subsequently rupture into the pleura.

This may occur not only because of cough but also because of the tearing of adhesions while artificial pneumothorax is being produced. As a complication of tuberculosis, however, he found only 20 cases of tuberculous empyema out of 902, a total of 2.2 per cent. Twenty-eight patients were treated

with artificial pneumothorax, and ten developed empyema in the course of induced pneumothorax, nine with definite symptoms of rupture of the lung. In summarizing his work, he believes that empyema is a complication of pulmonary tuberculosis, usually the result of rupture of the lung, that the exudate is pus in the ordinary sense of the term, and that the presence of the bacillus of tuberculosis in the exudate is the rule.

INCIDENCE OF TUBERCULOSIS WITH EMPYEMA

Most of our patients come to us, after having been operated on elsewhere, with very definite chronic empyema and a draining sinus. A large number of these are postpneumonic but there is a varying percentage whose history is suggestive of tuberculosis and during whose examination, by the methods outlined, tuberculosis as the causative factor has been diagnosed. This relationship of tuberculous empyema to chronic pyogenic types of empyema is noted throughout the literature as occurring in a variable percentage of cases, but the lower limits are comparatively uniform. From year to year, tuberculosis appears in from 5 to 20 per cent of all cases of chronic empyema. During the years that followed the epidemic of influenza, the relative percentage of tuberculosis dropped even lower. Last year, Harrington reported the incidence in the Clinic to be approximately 5 per cent. In 1920, Hedblom reported nine cases of tuberculosis as being diagnosed clinically in a series of 115 cases of chronic empyema, seven of empyema with pneumothorax, and eight of empyema with bronchial fistula. Wilensky reported 297 cases of acute empyema, only 2 per cent of which were caused by tuberculosis. In the second series of 574 cases of pleural exudate, he found the bacillus of tuberculosis in seven, an incidence of about 2 per cent. I have not been able to discover in the literature so small an incidence of tuberculosis.

MECHANISM CONTROLLING THE TYPE OF EFFUSION

In MacCallum's description of the reactions occurring in tissue damage he makes four chief divisions: inflammation, fever, immunity production, and repair. The effusion itself is due to the vascular response to injury, which results in bringing much blood to the affected part and pouring out its elements on the injured tissue to prevent extension of the injury, to hold in check the injurious agent, or even destroy it. Therefore one would expect to find all the products of the blood in a pleural effusion resulting from traumatism by infection, blood serum, fibrin, blood cells of all character, and as a result of the irritation, tissue cells the duty of which would be ultimately the clearing away of the débris resulting on the reaction incident to an infectious invasion. Some peculiar reaction, however, must appear in tuberculosis, making it possible, in most instances, for serous or serofibrinous pleurisy to develop, and for the cytological formula of Widal, in which the lymphocytes preponderate over leucocytes, to be so frequently observed. It may be true, as Floyd believes, that the chemiotaxis which is one phase of inflammatory reaction is a variable mechanism and causes a definite response to different stimuli. He quotes Froin who classifies pleural exudates according to whether or not the cellular or serous character predominates, the type depending, he believes, on the interrelationship between the infectious elements and the chemiotactic action resulting from stimulation; when chemiotactic action predominates and cellular destruction is mild, the exudate is purulent, but when the cytolytic and the chemiotactic actions are parallel, a serous or serofibrinous effusion occurs. It may be true that in tuberculosis this parallelism obtains.

Opie, however, believes that another mechanism is always at work, although his theory does not contradict the belief that variable chemiotactic reactions may result in the different types of effusion. Although the migration of leucocytes is a response to the attraction of some irritant or the products of it, all types of cell are not equally attracted. Most acute inflammations attract polymorphonuclear leucocytes, but in such diseases as typhoid fever and tuberculosis, the lymphocyte seems to be mainly attracted. Opie believes that a relationship exists between the leucocytes that are attracted and the serum.

The leucocytes produce a substance known as leucoprotease which may be inside the cell to digest broken-down ingested material but which on the breaking up of the cell may be set free so that autolysis of fibrin and other materials results within the effusion, and pus is produced. The action of the leucoprotease is controlled by the antienzyme which is in the blood plasma. He illustrates his idea, calling attention to the fact that in focal areas of inflammation, the leucoprotease exceeds its serum antienzyme and an abscess is formed, but in the presence of a large amount of serum, as in the pleural space, the antienzyme preponderates and holds the leucoprotease in check so that a purulent effusion cannot result.

One of the most important observations, so far as clinical and surgical work is concerned, is found in Opie's work, namely, if in the pleura the serum is withdrawn then the leucoprotease is increased and the serum antienzyme decreased, autolysis occurs and purulent exudate takes the place of serous. If his assumption is correct, it explains accurately why the patients in this series, whose serous exudates had been interfered with surgically by drainage, became chronic invalids and were ultimately forced to submit to long periods of invalidism and to devastating types of surgical operations.

The time relation between the removal of fluids and the prognosis is shown by one of Opie's experiments. If he made one injection into the pleural cavity of a dog, he always obtained a serous effusion, the animal always recovered, and its pleura returned apparently to normal, owing to one of the protective mechanisms which is provided the pleura enabling it to withstand infection with minimal damage. Floyd's experiments in injecting as many as 500,000,000 living streptococci, staphylococci, or pneumococci are evidence of this. If, however, Opie removed fluid by aspiration at the height of exudation, localized pleural abscess often resulted.

This is an important and practical observation, and is in keeping with our clinical experience that too early and too thorough a removal of fluid is not indicated. Wilenski observed in his acute cases of empyema a gradual decline in the mortality the longer the pus had been in the pleural cavity, and he did not think operation should be performed as long as the fluid was thin and had been present only 24 or 48 hours. Such operations increase the percentage of mortality. This is only one of several reasons for deferring operations in acute cases of effusion, particularly those that have been recognized since the influenza epidemic of 1918.

THE POSSIBILITY OF THE OCCURRENCE OF PRIMARY PLEURAL TUBERCULOSIS

In so many cases of the series the effusion appeared without preceding acute illness of any sort that the possibility of the occurrence of primary pleural tuberculosis must be considered. There are many mechanisms by which this might occur. Snow Miller has shown the definite relationship of the deep and superficial lymphatics and the means by which infection could easily find its way through the lung to the pleura. Ghon and Albrecht have discussed the possibility of bronchial lymph-node invasion without a recognizable pulmonary lesion. It is true that in Ghon's cases there were 170 in which a very careful search revealed the primary lesion in the lung, yet in fourteen (7.6 per cent) of 184 cases no focus in the lung could be detected.

It will be noted, however, that in these cases of lymph-node involvement without a recognizable focus in the lung, evidence of pleurisy was obtained suggesting the possibility of invasion by the bacillus of tuberculosis. The localization of the foci in conjunction with the residual deposit after the lapse of pleuritis on the same side doubtless points to the lungs as the source. "Two possibilities must be taken into consideration in this connection: that the virus had passed the lungs at the time of infection, and that the corresponding focus in the lung had not been found. I have no right to reject the first inference in every case, for I cannot prove the second"(10).

Garwitz and Arnold noted that bacteria in the inspired air could be absorbed by the lymphatic apparatus of the lung and cause an inflammatory reaction of the pleura alone.

Heller described collections of lymphadenoid tissue in the visceral pleura and noted that they formed counterparts to the bronchial lymph nodes. Similar lesions affected both sets of glands. Netter could determine in four instances that the empyema was independent of any other lesion.

Hodenpyl was often able to find at necropsy on adults a more or less thickly studded pleura with tiny white circumscribed nodules or patches, that were not simple fibromata or fibrous hyperplastic growths the result of pigment, but in most instances, he believed, the result of miliary tuberculosis, the miliary tubercles being frequently found on the pleura without parenchymal tuberculosis and particularly likely to undergo healing changes. If, however, healing is not complete, fresh tubercles will form in the surrounding areas of lowered resistance and by caseation and rupture allow the escape of germs resulting in an exudative inflammation producing serum, fibrin, and pus. Of Hodenpyl's 131 necropsies on adults from 14 to 92 years of age, in forty-five nodules were found on the visceral pleura which he believed were miliary nodules; this was later proved in forty-one instances.

There are, of course, many mechanical possibilities for primary tuberculosis within the pleura, as bacilli may be carried by the blood stream or by the lymphatics directly from the air vesicles, bronchial lymph nodes, chest wall, or from foci within the neck, and very often fresh tubercles are seen in the tissue of low resistance surrounding a primary lesion. If the original lesions are close to the pleura, one has no hesitancy in believing that the pleura may be involved by disease starting with symptoms characteristic of primary pleurisy. Therefore, the clinical evidence from the history and the examination may give a high percentage of cases of primary pleurisy due to tuberculosis, yet it must be remembered that the pleura, like the peritoneum, is most often subject to secondary disease.

INDICATIONS FOR REMOVAL OF FLUID

From the cases studied it is evident that serious damage can be done by hasty or ill considered operation on the patient with either a serous or a sterile purulent effusion. From the standpoint of treatment, it is essential that all cases should be considered tuberculous, for only then will certain restrictions be observed. There are five working rules for the removal of fluids: (1) fluid may be removed by tapping for the purpose of making precise laboratory examinations; clinical examinations are naturally unsatisfactory in determining the character of fluids within the chest, and without obtaining the exudate itself a positive diagnosis in many instances is not possible, a presumptive diagnosis only being possible; (2) if pressure symptoms are present, such as aphonia, dyspnœa, cyanosis, tachycardia, and cardiac failure, the removal of fluid is permissible; (3) when the chest contains so much fluid as to cause mediastinal dislocation, a sufficient amount may be withdrawn to restore the mediastinum approximately to its normal position; (4) pleural effusions that fail to be absorbed after a sufficient time interval may be withdrawn with justification, and (5) when the fluid is located bilaterally, it should be removed. Recently a method of withdrawing fluid from the two sides through one suction apparatus has been devised. This device was necessary in the case reported because of symptoms developing from dislocation of the mediastinum and resultant cardiac failure. It never seems wise to withdraw all the fluid, and frequently the withdrawal of only a small amount will disturb the equilibrium sufficiently to stimulate rapid absorption. Clinical experience has shown that whereas aspirating a large amount of fluid seems to stimulate further exudation, aspirating a relatively small amount results in an augmented rate of spontaneous absorption (Hedblom). With an infectious serous effusion, as is sometimes seen in streptococcal pleuritis, the onset of empyema is to be expected, and although aspiration is indicated, yet tube drainage or rib resection may be necessary. In cases of sterile purulent effusions similar rules hold also. A study of this series of cases seems to prove that it is a mistake to assume that the presence of such purulent effusions is necessarily damaging. As a matter of fact, many authors believe that

the lung is improved by its presence through an established immunity. Hedblom says: "Patients with sterile purulent exudate are of the type most liable to become the victim of injudicious surgery. This condition represents an exception to the rule *ubi pus ibi evacue* for the simple reason that there is no pus in the sense of the word used in this hackneyed phrase." Certainly the one important lesson that seems to stand out in the treatment of pleurisy with sterile effusion is that open operations in this type of case are disastrous. This may be said in spite of certain unhappy results that may occur if fluid remains too long in the chest. There is danger of formation of adhesions with permanent fixation of the lung in an abnormal position with relation to the chest wall, as well as of persistent re-accumulation of the effusion.

METHODS OF EXAMINING THE EXUDATE

In the present series of cases three types of examination were carried out. Two of the types do not afford immediate aid; it takes weeks to carry out guinea-pig inoculation, and pathological material can be examined only in the cases of the unfortunate patients whose first infection has become contaminated by various bacteria, so that they not only have empyema but tuberculosis to contend with. The work of Musgrave, Duboff, Zebrowski, Widal and Rivaut, as well as many others, would incline one to believe that many varieties of examinations may be necessary. In the order of importance the methods of value at our disposal are as follows:

1. *Ascertaining the character of the exudate.* Lymphocytes predominate in a large proportion of fluids resulting from primary pleurisy with serofibrinous effusion. This is not an infallible rule but is of value when positive. Sanguineous effusion is usually indicative of either tuberculosis or malignancy of the lung or pleura.

2. *The cultivation of bacilli.* A sterile fluid is suggestive of tuberculosis. In pneumococcal infections also, the pneumococcus may have died out and the pus be sterile. The history and associated clinical examination can assist in the diagnosis. Staphylococcus is an unusual germ in empyema; when it is found, it suggests the presence of tuberculosis (Netter).

3. *The direct smear in the search for the bacillus of tuberculosis.* The examination may be negative on a number of occasions and yet be positive finally. In this respect, examination of the direct smear is comparable to examination of sputum, it will reveal positive findings in only about 20 per cent of the tests.

4. *Inoscopic examination of Jousset.* By this laboratory procedure the clot formed is removed and digested, after which the residue is incubated, centrifugated, and examined for the bacillus of tuberculosis. The technique is described by Musgrave.

5. *Zebrowski's sedimentation method.* Large amounts of fluid are used; coagulation is prevented by adding sodium fluoride, and sediment is allowed to collect. By this method the bacillus of tuberculosis has been found in 55 per cent of primary, and 83 per cent of secondary, cases.

6. *Animal inoculation.* Variable results have been reported, probably depending on the methods and amount of fluid employed. Thus, Lord had 22.7 per cent positive results in sixty-six cases, Eichorst had 62 per cent positive but used 15 cubic centimeters of effusion for his inoculation, and LeDamany had 85.4 per cent, using 300 cubic centimeters of effusion for his inoculation, but gave them in divided doses.

7. *Examination of pathological material.* These methods have been discussed earlier in the paper.

TREATMENT

This series of cases seems to show that patients who are treated conservatively at the beginning make the quickest and the most satisfactory recoveries. It is essential that they be treated for tuberculosis rather than for an infection in an organ, and that ordinarily the ill effects of pressure be guarded against by sufficient but not dangerously frequent aspirations. When sepsis occurs, however, either from connection with the parenchyma of the lung and the bronchi, or from without, the situation is totally different, and it is necessary to institute drainage. The surgeon must assist the inflammatory process by removing the débris that the body is unable

to care for. Thus the type of operation done for chronic empyema becomes necessary for tuberculous empyema.

CONCLUSIONS

It would seem wise to regard all cases of serous effusion as tuberculous, and to bear in mind that a great deal of harm can be done by hasty or ill considered treatment, and that a large percentage of all cases of empyema, especially if not preceded by pneumonia or sepsis, are also tuberculous.

In planning methods of treatment, great care should be exercised in the preliminary evaluation of the history, in the examination of the aspirated fluid, and in the consideration of implications involved in cases of sterile exudate. Any lack of such care and consideration results in failure to conduct treatment intelligently, and reduces the patient to a condition of chronic invalidism. Should the patient finally recover from the subsequent necessary operative procedures the end-result, although satisfactory, is not a triumph but rather a test of his own vitality.

BIBLIOGRAPHY

1. Albrecht, Eugen. Zur Einteilung der Geschwuelste. Frankf. Ztschr. f. Path., 1909, iii, 1–7.
2. Bowditch. Quoted by Lord.
3. Cabot. Quoted by Sears, G. G. The prognosis of idiopathic pleurisy. Boston M. & S. J., 1904, cl, 209–210.
4. Dieulafoy. Quoted by Norris and Landis.
5. Duboff, William. Tuberculous empyema. Am. Rev. Tuberc., 1919–1920, iii, 590–604.
6. Eichorst. Quoted by Lord.
7. Floyd, C. The interrelationship of dry pleurisy, pleurisy with effusion and empyema. J. Med. Research, 1914–1915, xxxi, 261–275.
8. Froin. Quoted by Floyd.
9. Garwitz and Arnold. Quoted by Wilensky.
10. Ghon, Anthon. The primary lung focus of tuberculosis in children. New York: Hoeber, 1916, 172 pp.
11. Harrington. Personal communication.
12. Hedblom, C. A. The treatment of chronic empyema. Ann. Surg., 1920, lxxii, 288–326.
13. Idem. The diagnosis and treatment of tuberculous empyema. Surg., Gynec. & Obst., 1922, xxxiv, 445–465.
14. Hedge. Quoted by Lord.
15. Heller. Quoted by Wilensky.
16. Hodenpyl, E. Miliary tuberculosis of the pleura without other tuberculous involvement of the lung. Med. Rec., 1899, lv, 903–907.
17. Jousset, A. Sur une nouvelle méthode de recherche du bacillie tuberculeux. Bull. et mém. Soc. méd. d. hôp de Par., 1903, xx, 23–26.
18. Koester, H. Pleuritis und Tuberculose. Ztschr. f. klin. Med., 1911, lxxiii, 460–478.
19. LeDamany. Pleuresies sero-fibrineuses. Presse méd., 1897, 329–331.
20. Lemon, W. S. Tuberculous enterocolitis. Minnesota Med., 1923, vi, 572–578.
21. Lemon, W. S., and Doyle, J. B. Clinical observations of Hodgkin's disease, with special reference to mediastinal involvement. Am. J. M. Sc., 1921, clxii, 516–525.
22. Lord, F. T. Diseases of the pleura. Osler and McCrae: Modern Medicine, 2d ed. Philadelphia: Lea and Febiger, 1914, ii, 1004–1048.
23. MacCallum, W. G. Textbook of Pathology. 2d ed. Philadelphia: W. B. Saunders & Co., 1920, 132–157.
24. Miller, William S. Some essential points in the anatomy of the lung. Am. J. Roentgenol., 1917, iv, 269–279.
25. Musgrave, Percy. Examination of pleural fluids with reference to their etiology and diagnostic value. Boston M. & S. J., 1904, cli, 317–321.
26. Netter. Quoted by Wilensky.
27. Norris, G. W., and Landis, H. R. M. Disease of the Chest. 3d ed. Philadelphia: W. B. Saunders & Co., 1918, 782 pp.
28. Opie, E. L. The transformation of serofibrinous into purulent pleurisy. J. Exper. Med., 1907, ix, 414.
29. Osler. Quoted by Lord.
30. Sokolowski. Quoted by Lord.
31. Widal and Rivaut. Applications cliniques de l'étude histologique des épanchements séro-fibrineux de la plevre (Pleurésies mécaniques). Compt. rend. Soc. de biol., 1900, lii, 651–653.
32. Wilensky, A. O. Empyema of the thorax. Surg., Gynec. & Obst., 1915, xx, 501–514; 647–656.
33. Zebrowski, E. Zur Frage der Untersuchung der pleuritischen Exsudate auf Tuberkelbacillen. Deutsche med. Wochenschr., 1905, ii, 1425–1426.

ANEURISMS OF SCARPA'S TRIANGLE[1]

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IT is the aim of the authors in presenting the following discussion and report of cases to review some of the commonly known facts relative to aneurisms in this locality, and to emphasize now and again certain phases of the work which we feel merit special consideration.

Probably no better example of the chaotic condition of our knowledge of blood vessel surgery is to be had than that expressed by LaRoque in the following extract taken from one of his recent articles (31).

"Along with the lack of practice in the technique of suturing and tying large arteries and veins, the surgeon, when confronted by the management of such an injury, feels also need for clear-cut authoritative information which will lead him to pursue exactly the proper course in dealing with these injuries, often among the most dramatic situations in the practice of surgery. What to do, what not to do, and when and how and why, these are the questions. Disappointment is apt to follow expectation to secure the information necessary to a solution of the problems, from a study of the clinical case reports in literature. The records of laboratory work fail to elicit the completely assembled practical instruction which one needs at his 'finger tips' in clear-cut formulated plans of procedure."

Aneurisms have been known to physicians since remote antiquity. Rufus, of Ephesus, and Galen described aneurisms of traumatic origin, Antyllus described those of spontaneous origin, and to William Hunter (22) probably belongs the credit of having first clearly described an arteriovenous aneurism. Notwithstanding our long acquaintance with these lesions, we apparently have much to learn if we are to place the surgical care of these cases beyond the "hit or miss" position which it now occupies.

Approximately 8 per cent of all aneurisms are those of the femoral artery (8). To bullet and stab wounds, lues, and surgical accidents can be attributed more than 90 per cent of all aneurisms.

The close relationship existing between the femoral artery and vein in Scarpa's triangle makes for their simultaneous injury. Of our seven traumatic aneurisms, six (Cases 1, 2, 3, 4, 5, 6) were arteriovenous and all six were the result of bullet wounds. The other traumatic aneurism (No. 8) followed the surgical removal of an infected inguinal gland three and one-half months previous to the appearance of the pulsating tumor at the site of the operation. It is possible that lues had a part in the etiology of this case since on examination it was found that the patient had a four plus Wassermann reaction. In our three spontaneous aneurisms (Cases 7, 9, 10) the Wassermann was positive in each case.

In no case did we have more than one diagnosed aneurism in the same individual, although we had in mind the fact that two and even three of the femoral artery have been reported by Antonio Scarpa (35), Fleury (11), and others. In reviewing our cases one is at once impressed by the importance of bullet wounds in the causation of vessel injuries in civil life, and still more impressive is the fact that in every case of gunshot injury to blood vessels in this area an arteriovenous aneurism was produced.

SYMPTOMATOLOGY

1. *Simple aneurisms or true aneurisms.* The tumor mass in these cases varies greatly and there is some question as to what extent a vessel may dilate before the wall of the aneurism ceases to be composed of the histological elements common to arteries. In one of our patients (Case 7) the tumor mass measured about 12 centimeters in diameter. The third one of our series presented a fusiform dilatation of the femoral about 8 centimeters long and 4 centimeters wide. The other patient (Case 10) was cognizant of a small, almond sized mass on the inner side of the leg, but attached little significance to its presence until he suddenly experienced a sharp pain in the tumor mass and was seized with a sense of faintness and dizziness. The thigh rapidly in-

[1] Read before the Chicago Surgical Society, February 6, 1925.

creased in size until it measured half again that of the normal limb. The entire thigh became tense and œdematous, and showed a heaving, expansile pulsation synchronous with the heart beat. In one patient in the group (Case 8) we were able to follow the development and changes in the aneurism during the course of a typical lobar pneumonia. During the illness, the size of the aneurism increased by nearly one-half. We feared that during one of his spasmodic coughing attacks a rupture of the sac wall would surely occur, and so far as we knew, nothing could be done to prevent such a calamity. We considered compression but felt that this would not be justified in the presence of his already embarrassed cardiac action. Fortunately he weathered the pneumonia, and we were able to operate on him some time later with an excellent final result.

Sensory and motor disturbances. Pain was complained of by all four patients. The size of the aneurism seemed to have less to do with its severity than the location. When the nerves were compressed or stretched by the dilated sac symptoms were often marked. In two cases the patients thought the pain was rheumatic until the tumor mass was of considerable size.

Anæsthesia was present over variable areas below the tumor masses. Paresis was present in Case 10 and he suffered such pain that it was impossible to persuade him to attempt any voluntary movement of the extremity so the degree of motor disturbance was hard to estimate. Marked weakness of the quadriceps femoris was present in Case 7.

Venous obstruction. In two of our series (Cases 9 and 10) there occurred marked œdema of the lower leg due in the one patient (Case 10) to the spreading arterial hæmatoma causing compression of both the superficial and deep veins, and in the other patient (Case 9), it resulted from lateral compression of the common femoral vein close to Poupart's ligament. The two remaining cases showed little interference with venous return flow.

Murmurs. Soft blowing murmurs, systolic in time, were present in 3 cases, while in the arterial hæmatoma case the murmur was loud and somewhat resembled those heard in arteriovenous aneurisms.

Thrills. Only one of our patients (Case 6) presented a thrill on palpation. Reports indicate that thrills are not common except in arteriovenous aneurisms.

SPONTANEOUS RUPTURE

This complication occurred in only one of our cases (10). Where such a rupture occurs, converting a true aneurism into an arterial hæmatoma or false aneurism, it adds greatly to the likelihood of subsequent gangrene since the wide extravasation of blood not only produces pressure on the collaterals, lowers the blood pressure in the general circulation and in the artery peripheral to the rupture, but the reaction in the tissues as a result of dissection of the blood along the muscle and fascia planes offers a serious hindrance to the development of collateral circulation.

Makins (26) in discussing traumatic arterial hæmatomata says that the tissues surrounding these arterial hæmatomata react in a remarkable manner to the stimulus afforded by the presence of the blood clot in their midst. The connective tissue of the vascular cleft, the intermuscular spaces, and the muscles themselves become infiltrated with serum and an abundance of leucocytes destined to take part in the subsequent absorption of the clot. A considerable part of the mass of the tumor in the early stages consists of this surrounding infiltration; and the gradual disappearance of the latter and of the œdema accounts for much of the diminution in the apparent size of the tumor.

ARTERIOVENOUS ANEURISMS

The recent contributions to the literature of this singular lesion by Halstead (20), Gessner (13), Callander (4), Reid (34), Holman (23, 26), and Hoover and Beams (23) has stimulated a renewed interest in this type of aneurism. In this presentation, we shall not attempt to discuss the interesting phases of pathological physiology presented by these cases. We propose to confine ourselves to the clinical aspect as closely as possible. Various types of arteriovenous aneurisms are described. The simplest form is the aneurismal varix in which the opening in the artery is in direct apposition to the opening in the vein. Makins

recognizes six types depending upon the arrangement of the aneurismal sac.

The vein is generally described as playing a secondary part, although it may furnish the major portion of the tumor mass.

DEVELOPMENT OF ARTERIOVENOUS ANEURISMS

This type of aneurism is often not recognized for some considerable period after the initial injury. This period of latency in diagnosis may have two explanations: first, an interposed hæmatoma formed at the time of the injury may delay the formation of the fistula until shrinkage or absorption of the clot allows the vessels to communicate; second, the communication which may be comparatively small at first may enlarge and the bruit and thrill make their appearance some time after the injury. One of the patients (Case 2) was shot in 1912, and it was not until 1917 that the swelling of his leg, pulsation, and accompanying pain were marked enough to cause him to seek surgical aid. His condition gradually grew worse and he entered the Cook County Hospital in 1923, 11 years after the initial injury.

SACS OR TUMOR MASSES

The tumor masses in arteriovenous aneurisms rarely reach as large a size as those seen in simple aneurisms although dilatation of the vein and its tributaries may produce a mass of some considerable size. In one of our patients (Case 5), there were large nodular varicosities extending well over the symphysis pubis toward the umbilicus. In Case 2, the involved leg showed marked varicosities, and a varicose ulcer was present over the anterior aspect of the lower leg. The varicosities had been operated upon by a surgeon in an attempt to cure the ulcer some time previous to his admission to our service.

SIGNS OF ARTERIOVENOUS ANEURISM

Murmur. The murmur has been variously described as machine-like, rumbling, whistling, or like a millrace. It lasts throughout the cardiac cycle, being loudest during systole. As the condition progresses or recedes the murmur may change in character. It is interesting to note that the murmur can often be heard with the ear several inches from the skin surface. Makins (26) emphasizes the fact that the height of pitch of the murmur is a valuable guide to the exact site of the fistula. It is highest and loudest immediately over the communication. A further interesting phenomenon in connection with the murmur is its transmission along the course of the large vessels both centrally and peripherally. In one of our patients (Case 2) it could be heard distinctly over the internal malleolus, and centrally could be traced to the epigastric region.

Thrills. The thrill like the murmur is continuous throughout the cardiac cycle and most marked during systole. It is described as purring or bubbling in character. Holman (18, 19) believes it to be due to the vibration of the proximal septum between the artery and vein, which is set in motion by the swirling, eddying stream of blood as it rushes from the artery with its high pressure to the vein with its lower pressure. Holman also states that the intensity of the thrill may serve as a guide to the volume of blood flowing through the fistula. The thrill may be palpated at some distance from the site of injury. Both murmur and thrill were most marked in the case which had existed 11 years; the least marked in a recent case of aneurismal varix.

Venous pulsation. In none of our cases could there be seen definite venous pulsations. Such pulsations are more common in arteriovenous lesions in the neck. The distention of the superficial veins, imposed as they often are upon the dilated artery and deeper vein, coupled with the marked arterial pulsation, may give one the impression of pulsating veins.

Venous stasis. More or less œdema was present in every case. It varied in degree from faintly discernible pitting on pressure to the extreme congestion, varicosities, and œdema found in Case 2.

General circulatory derangements and heart conditions. Attention has been repeatedly called to the presence of murmurs at the base of the heart in cases of arteriovenous aneurism. We have been unable to verify this finding in our cases although we have sought the co-operation of the internist on several occasions. Several of our cases showed increased size of

heart and one (Case 6) showed an enlargement of the liver to about three fingers' breadth below the costal margin. After operation the heart dulness receded and the liver returned to normal size. Electrocardiographic tracings in one case showed no change from normal. We made X-ray examinations of the base of the heart and aortic region in two cases, neither of which showed any widening or change of note.

Pulse rate. As a rule the pulse rate is fairly rapid in these cases, ranging around 90 to 100. Branham (3) in 1890 called attention to the marked slowing of the pulse when an arteriovenous fistula was compressed. In some instances the pulse rate will be decreased by half. This decrease in pulse rate is not a permanent affair, but tends to disappear when pressure is released or the fistula is permanently occluded by operation. In one of our cases the pulse rate increased on compression of the fistula area, and in another the rate decreased from 82 to 76. We believe that the extent of the collateral circulation may be a factor in lessening the reaction to the closure of the fistula.

Blood pressure. There is usually some increase in the systolic blood pressure and a lowering in the diastolic pressure where an arteriovenous aneurism has been produced. It is interesting to note that the blood pressure and pulse rate are both affected by closure of the arteriovenous fistula. Immediately after the closure, there occurs a decided increase in both systolic and diastolic pressure. Some considerable time after the operative closure of the fistula the systolic pressure usually returns to near normal, or at least to the preoperative level, while the diastolic usually maintains a slightly higher level than was present before operation. This we have observed in several cases.

DIAGNOSIS

The direct diagnosis of typical simple or arteriovenous aneurisms presents little difficulty. However, in certain instances serious results have followed errors in interpreting the causation of certain tumor masses in or near the groin.

Cayley (5) reports an aneurism of the left femoral which became converted into a large abscess. In our series, Case 10 was being treated by hot fomentations with a view to incision when a fluctuating area developed. The condition had not been diagnosed up to the time he came to our service.

Gay (12) reports a femoral aneurism which so closely simulated a femoral hernia that he was in doubt of the diagnosis for some time. Gloag (15) gives an account of a femoral aneurism which was incorrectly diagnosed as a malignant tumor. Putiatycki (33) speaks of a case from Langenbeck's clinic where a femoral aneurism eroded the horizontal ramus of the pubis and the hip joint, and the diagnosis was extremely difficult.

An arteriovenous aneurism is often overlooked because of the mildness of its symptoms and the unobtrusiveness of its signs. The characteristic murmur and thrill if once heard, usually serve as reliable guides to a correct diagnosis.

INDICATIONS FOR OPERATION

Experimentally it has been shown that the fistulous communication in arteriovenous aneurisms may close spontaneously. However, we doubt if we are ever justified in treating either spontaneous or traumatic aneurisms expectantly.

Threatening rupture, external hæmorrhage, subcutaneous hæmatoma formation, or rapid increase in size, are indications for immediate operation.

Cardiac embarrassment and extensive varicosities call for early treatment in arteriovenous aneurisms.

The advisability of awaiting collateral circulation development in traumatic cases is, to our minds, a waste of time in aneurisms of the femoral in this area. In the Matas Clinic they use the Massachusetts General compressor to encourage the development of collaterals. Many ingenious devices and interpretative tests have been applied with the hope of eliciting the amount of collateral circulation and a very thorough review of this phase of the work is to be found in an article by Matas, of New Orleans, published in 1914.

PRE-OPERATIVE MANAGEMENT

When lues is present in either type of aneurism, a thorough treatment with mercury

and potassium iodide should be immediately instituted and resumed as soon as possible after operation.

Cases showing cardiac embarrassment, marked œdema, or extreme varicosities should have the benefit of rest in bed for a reasonable period previous to operation.

NON-OPERATIVE TREATMENT OF SPONTANEOUS ANEURISMS

We think that we may pass as incidental the reports of cases of peripheral aneurisms treated by application of ice (16), administration of veratrum viride (1), ergotin (32), gelatine and similar procedures.

The use of compression, either by instruments of the type of Reid's pelvic instrument, Carte's elastic band, by compressors of the type of that commonly designated as the Massachusetts General Hospital compressor, or by digital pressure, has some very staunch advocates. Delbet (10) reports 111 cases of aneurisms treated by digital compression of which 76 were cured (68.5 per cent). Vialle (36), Colle (30), and Holt (21) report cures from this same method. Lawson (24) reports a case of femoral aneurism treated by pressure on the abdominal aorta. While there may be cases in which these methods are indicated, they undoubtedly make up a very small percentage.

OPERATIVE TREATMENT

It is difficult to lay down any hard and fast rules in the treatment of aneurisms in general, but we believe we can formulate a fairly reliable working plan for aneurisms of the femoral artery in Scarpa's triangle.

To avoid confusion, let us discuss the treatment under the following headings:

1. Provisional control of vessels proximal and distal to the aneurism.
2. Exposure of the sac in spontaneous simple aneurisms or of the fistula in arteriovenous aneurisms.
3. Management of the sac.

Provisional control of vessels. If the aneurism is high up in the common femoral close to Poupart's ligament, it has been our practice to proceed as in the usual manner for extraperitoneal ligation of the external iliac, except that instead of catgut or silk, we have used a wide, flat, silk, obstetrical tape passed separately beneath the artery and vein and held as slings. We have found this procedure so easy and so satisfactory that we have used the rather high control where we might have used an incision along the artery below Poupart's ligament. It has been found in our work that slight angulation of the vessel with the forefinger compressing the vessel wall, will readily control the femoral artery and vein from above. Gibbon (14) has recently urged that the circulation should be controlled by digital compression because the use of clamps or ligatures may cause the subsequent development of an aneurism at the site of their application. We are, however, not ready to dispense with our proximal tape sling.

When the aneurism is far enough below Poupart's to insure ready access to the femoral vessels without fear of encountering the sac, we place our tapes in this region. In spontaneous aneurisms and in arterial hæmatomata it must be remembered that the vessels are often diseased or surrounded by inflammatory tissue for some distance proximal to the sac, and the application of ligatures or clamps is a task. In such cases it is sometimes easier and safer to use the approach suggested for lesions close to Poupart's. In the majority of cases we have found it unnecessary to place provisional ligatures or slings below the aneurism site.

Exposure of the aneurism. After having applied our provisional controls, we begin our incision below the aneurismal sac and dissect carefully toward its most prominent area. In two of our cases it was necessary to connect the oblique incision above Poupart's ligament with the longitudinal incision along the course of the vessel. In these incisions we severed Poupart's ligament directly over the artery and vein, thereby giving us complete exposure of the femoral artery and about one and one-half inches of the external iliac.

Management of sac. In spontaneous aneurisms we resorted to quadruple ligation in every instance. In three of the cases we excised the sac and ligated or sutured the bleeding areas. We quite agree with Gibbon (14) that one of the most important measures to take in order

to avoid infection is complete hæmostasis. However, we do not completely subscribe to his fear of small gutta percha drains placed in the wounds to allow serum or slight oozing of blood to find a ready exit along their tract. We have repeatedly used such small strips, and so far have had no regrets. In one spontaneous aneurism near the apex of Scarpa's triangle, we made use of the obliterative type of endo-aneurismorrhaphy suggested by Matas(27).

In arteriovenous aneurisms, we performed quadruple ligation in each instance. In 4 of the 6 cases we excised the sac and the fistulous communication. In two instances we obliterated the artery and vein between the ligatures by running sutures of catgut. In both of these cases there were large varicosities extending over the region so that excision seemed less suitable than suturing.

DISCUSSION

Speaking before this society it would seem thoughtless not to mention some of the ingenious and surgically artistic repairs which have been accomplished in arteriovenous aneurisms. To the late Dr. Murphy belongs the credit of having successfully done an anastomosis of the femoral artery and lateral repair of the femoral vein in an arteriovenous aneurism of Scarpa's triangle. Mention should also be made of the works of A. E. Halstead and Carl Beck. Innumerable cases have been reported of anastomosis of both vein and artery, of each with repair or obliteration of its fellow, or of repair of lateral rents in each. The Matas-Bickham operation has some features of interest, but it is probably better suited to other localities than to the area under discussion.

POSTOPERATIVE TREATMENT

Luetic treatment should be resumed in cases showing a positive Wassermann or clinical lues.

No splints or pads should be applied to the leg.

The leg should be depressed rather than elevated, as has been suggested in most instances. The patient should be encouraged to begin immediately active movements of the toes and ankle, and his position should be changed frequently so that no prominence is subjected to pressure for any considerable period of time.

A therapeutic light arranged under a blanket tent will supply heat to the entire extremity.

Dressings should be kept clean and free from moisture. The small gutta percha drains are removed within twenty-four hours.

CONCLUSIONS

1. Aneurisms of Scarpa's triangle are comparatively common.
2. Arteriovenous aneurisms outnumber the simple variety.
3. Trauma and lues are the important etiological factors.
4. In most cases provisional ligature of artery and vein followed by permanent quadruple ligation with excision or plication of sac will produce excellent results.

CASE REPORTS

CASE 1. White, male, age 26 years, Cook County Hospital Case No. 778141 was admitted to hospital November 7, 1921. Operation was done November 17, 1921, and he was discharged December 18, 1921. Patient had a gunshot wound about 8 inches below Poupart's ligament, followed by an arteriovenous aneurism. A tourniquet was applied for hæmostasis. Quadruple ligation and excision of the sac and fistulous area in artery and vein were done. No drain used. There was no infection, and the wound healed rapidly. Patient had no complaints and walked without limp on leaving hospital.

CASE 2. Negro, male, age 27 years, Cook County Hospital Case No. 849901, was admitted August 13, 1923. Operation was done August 18, 1923, and he was discharged September 21, 1923. Patient had a bullet wound of thigh in 1912. Varicosities and pain were most marked in last 4 years. An arteriovenous aneurism developed. Extraperitoneal provisional ligation of external iliac artery and vein was done and quadruple ligation and endo-aneurismorrhaphy were later performed. Two small gutta percha drains were inserted. The wound healed without infection. The patient showed great improvement before leaving hospital. He had an old ulcer of leg which had practically healed. The œdema of leg greatly diminished after operation.

CASE 3. Negro, male, age 25 years, Cook County Hospital Case No. 854289, was admitted September 21, 1923. Operation was done September 27, 1923. He had an arteriovenous aneurism of the femoral artery in the inguinal fold which was produced by a bullet wound inflicted 12 days before admission to hospital. Hæmatocele was present in left side of the scrotum. Extraperitoneal provisional control was followed by permanent ligation. Ligatures

were placed on artery and vein just below the fistula. Partial excision of sac and fistulous communication was done. Guttapercha drains were inserted and removed in 24 hours. Patient made excellent recovery and was discharged from hospital October 25, 1923.

CASE 4. White, male, age 14 years, admitted to Cook County Hospital, No. 859969, November 13, 1923. He had a bullet wound in the middle of the right thigh with arteriovenous aneurism of femoral artery. The wound was infected and exuded a purulent material on pressure. A tourniquet was applied and incision was made along the femoral artery, exposing an arteriovenous aneurism. Quadruple ligation with excision of sac was done. The spread of infection and a beginning gangrene made amputation necessary 8 days after admission. Patient was discharged March 11, 1924.

CASE 5. Negro, male, age 18 years, was admitted to Cook County Hospital, No. 866730, January 14, 1924. Operation was done February 21, 1924. Patient had an arteriovenous aneurism of femoral artery produced by a bullet wound which was received one hour before admission to hospital. Aneurism was found 1 inch below Poupart's ligament. Extraperitoneal provisional ligations of external iliac artery and vein were later made permanent ligatures. Ligatures were placed on artery and vein below aneurismal sac. Excision of part of sac and closure of collaterals by catgut suture were done. One forceps was left on small collateral because of friability of structures about artery. A small gauze pack was inserted in wound. Artery forceps were removed in 26 hours. He had a slight infection which cleared up in one week. Patient was discharged February 25, 1924. He walks without limp. Patient has since returned for examination and is working regularly and has no trouble with leg.

CASE 6. Negro, male, age 20 years, was admitted to Cook County Hospital, Case No. 890902, July 24, 1924. Eight weeks before admission patient was shot in upper right thigh. Pains and pulsation made him so uncomfortable that he sought relief. We found an arteriovenous aneurism of the right femoral about 8 inches below Poupart's ligament. Provisional ligatures were applied to the external iliac artery and vein by extraperitoneal approach. Quadruple ligation of femoral artery and vein followed by obliteration of sac and fistula by obliterative aneurismorrhaphy. Patient was discharged September 15, 1924. He is now working on express delivery and gets about without limp or inconvenience of any sort.

CASE 7. Negro, male, age 47 years, was admitted to Cook County Hospital, Case No. 821623, December 17, 1922. A tumor mass with pulsation had gradually developed in the right groin for last 2 months. Pain and difficulty in movement caused patient to enter hospital. Wassermann reaction was positive. Extraperitoneal provisional ligatures of external iliac artery and vein were applied and later made permanent ligatures. Ligation of artery and vein below area of aneurism. Aneurismal sac was dissected out. Incisions were closed with black waxed silk. There was a very small amount of oozing from the wound. Patient was discharged from the hospital January 20, 1923. He has been seen many times since he left hospital. He has never completely regained motor function of the quadriceps femoris. He walks with slight limp. Circulation in limb is good.

CASE 8. Negro, male, age 31 years, was admitted to Cook County Hospital November 8, 1923, Case No. 859373. Nine months previous to admission patient developed inguinal bubo which was later partially excised. About 1 month previous to admission, a tumor mass appeared at the site of the operation scar. This mass was tender and was the seat of sharp, stabbing pains which became so annoying that the patient sought relief. Wassermann was positive. Some areas of anæsthesia over thigh below tumor mass were found. Twelve days after admission patient developed typical lobar pneumonia. He was operated on November 20, 1923. Extraperitoneal ligation of iliac artery and vein was done. Ligation of artery and vein below aneurism. The sac was dissected out, the bleeding points ligated or sutured, and gauze drain inserted because of large dead space which was too friable to close with sutures. All of drain was removed 10 days later. No infection of wound. Patient has been seen many times since the operation. He is now a chauffeur and uses his leg all day in driving. He was discharged from the hospital December 13, 1923.

CASE 9. Negro, male, age 32 years, was admitted to Cook County Hospital, Case No. 876237, March 26, 1924. Six months previous to admission pulsation of jumping nature was present in right thigh. A tumor mass appeared in apex of Scarpa's triangle. Pain was so severe that the patient could not sleep. The right knee was swollen. Aneurism was fusiform in outline. Wassermann was positive. Operation was done on March 28, 1924. An incision was made over the femoral artery and vein above aneurism and provisional ligatures were placed; the sac was exposed; provisional ligatures were made permanent and artery and vein ligated below sac. The sac was obliterated by aneurismorrhaphy. Patient was discharged from hospital on April 21, 1923, with leg in excellent condition and apparently no lack of collateral circulation.

CASE 10. Negro, male, age 38 years, was admitted to Post-Graduate Hospital February 26, 1920. Ten days previous to admission he discovered a small painful pulsating tumor mass in right thigh. Tumor mass enlarged to the size of a golf ball, and on the tenth day ruptured. Thigh became quickly distended with blood, and a heaving expansile pulsation was present. Thigh measured 32 inches in circumference while normal side measured 22 inches. Pain was excruciating and motor power of leg was practically nil. Wassermann was positive. Operation, February 28, 1920. Provisional extraperitoneal ligation of external iliac artery and vein. An incision was made over the femoral artery, and the sac ex-

posed. A quadruple ligation with dissection of sac was completed. The incision was closed with interrupted stitches. A small cigarette drain was employed. Gangrene of toes and plaque over external malleolus necessitated amputation above the ankle. Patient discharged April 10, 1920.

BIBLIOGRAPHY

1. Blackmann. Femoral aneurism cured by veratrum viride. West. Lancet, Cinn., 1857, xviii, 407–409.
2. Blanco, J. Un caso de aneurisma. Siglo méd., Madrid, 1908, lv, 792–794.
3. Branham, Harris H. Internat. J. Surg., 1890, ii, 250.
4. Callander, C. The Johns Hopkins Hosp. Rep., xix, Fasciculus III.
5. Cayley. Tr. Path. Soc. London, 1869, xx, 114–117.
6. Collis, M. H. Dublin Quart. J. M. Sc., 1854, xviii, 315.
7. Creus, D. Juan. Aneurisma de la femoral. Siglo méd., 1879, xxvi, 375.
8. Crisp, A. Treatise on the Structure Diseases and Injuries of the Blood Vessels. London: 1847.
9. Davies-Colley. Case of traumatic aneurism of superficial femoral artery, recurrent after ligature and cured by laying open the sac. Lancet, London, 1876, ii, 606.
10. Delbet. Chirurgie artérielle et veineuse; les modernes acquisitions. Paris: 1906.
11. Fleury. J. gén. de méd., chir. et pharm., Paris, xxviii, 162–174; 175–184.
12. Gay. Buffalo M. & S. J., 1875–1876, xv, 417.
13. Gessner. Ann. Surg., 1924, lxxix, 370–374.
14. Gibbon, John H. Ann. Surg., 1924, lxxx, 325–332.
15. Gloag, G. A. Brit. M. J., 1873, i, 584.
16. Goldsmith. Tr. Soc. Alumni Coll. Physicians and Surgeons, Univ. State of New York, N. Y., 1842, No. 1, 6.
17. Grover, C. P., and Fisher, D. Wound of femoral artery and vein. Ann. Surg., 1923, lxxviii, 84–86.
18. Holman, Emile. Experimental studies in arteriovenous fistulas. Arch. Surg., 1924, November, 822.
19. Idem. Physiology of an arteriovenous fistula. Arch. Surg., 1923, vii, 64–82.
20. Halstead. Surg., Gynec. & Obst., 1918, December, and 1920, July.
21. Holt, B. A case of a large femoral aneurism treated by pressure. Tr. Clin. Soc., London, 1874, vii, 56–58.
22. Hunter, William. Medical Observations and Inquiries. 1761, p. 34.
23. Hoover, C. F., and Beams, A. J. Arch. Int. med., 33, 1924, xxxiii, 1–22.
24. Lawson, G. Large aneurism of the femoral artery successfully treated by compression of the abdominal aorta. Lancet, London, 1867, ii, 514.
25. Lucke, Baldwin, and Hague, Marion. J. Am. M. Ass., 1921, lxxvii, 935.
26. Makins, G. Gunshot Injuries to the Blood Vessels. New York: 1919.
27. Matas, R. Ann. Surg., 1903, iii, 42.
28. Ibid. 1911, January.
29. Meyer, W. Ligation of the external iliac for femoral aneurism three years after ligation of the femoral artery for popliteal aneurism of the same side. Ann. Surg., 1900, xxxi, 256.
30. Montgomery. Report of Colle's case. Dublin Quart. J. M. Sc., 1851, xi, 497.
31. LaRoque, G. Paul. Ligation of external iliac artery. Ann. Surg., 1921, lxxiii.
32. Plagge, T. Fall von Aneurisms arteriae femoralis mit Ergotin. Memorabilien, Heidelberg, 1873, xviii, 441–443.
33. Putiatycki. Quoted from Bergman, Bruns, Miculicz.
34. Reid, Mont R. Bull. Johns Hopkins Hosp., 31, 1920, xxxi, 43–50.
35. Scarpa, Antonio. Sull' aneurisma, riflessioni ed osservasioni anatomico-chirurgiche. Pavia: 1804.
36. Vialle, J. Piqure de l'artere fémorale droite (coup de gouteau); anévrisne vrai consécutif; compression digitale indirecte; guérison. Arch. de med. e.d. pharm. mil., Paris, 1896.

RESULTS IN SURGERY OF THE UTERUS AND ADNEXA[1]

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We present an analysis of results obtained in surgery of the uterus and adnexa during a period of 10 years on the Second Surgical Division of the New York Hospital. The analysis indicates to some extent the value and limitations of information obtained through a follow-up system. It is this feature which we wish to emphasize.

The following groups of cases will be considered:

Uterus	Cases
Fibromyoma	221
Carcinoma	45
Retroversion	159
Adnexa	
Salpingitis—	
Chronic	226
Acute	66
Tuberculous	19
Ectopic gestation	93
Ovarian tumors and cysts	133
Total	962

The data were taken from the routine follow-up reports which are filed with the case records; no special questionnaires were sent out. The operations were performed by the staff of five surgeons.

FIBROMYOMATA

There were 221 cases of fibromyoma of the uterus. The subdivisions of this group will not be specified.

There were 196 major operations, of which 171 were hysterectomies (supravaginal, 162; abdominal, complete, 6; vaginal, 3); and 25 were myomectomies (abdominal, 24; vaginal, 1).

In the remaining cases minor operations were performed, i. e., dilatation and curettage or removal of a polyp; and treatment by X-ray alone or by curettage followed by X-ray.

Follow-up. One hundred and eighty-seven cases were followed for a period of from 3 months to 8 years; 165 were judged "good" anatomically, symptomatically, and economically.

Immediate Results:

1. Mortality (while in hospital) 10 cases

	Cases
Following supravaginal hysterectomy	9
Following myomectomy	1

Causes in order of occurrence:

1. Myocarditis
2. Sepsis
3. Embolism (pulmonary)—myomectomy
4. Peritonitis
5. Intestinal obstruction
6. Bronchopneumonia
7. Tetanus (eleventh day)—autopsy
8. Peritonitis
9. Pneumonia
10. Intestinal obstruction

2. Morbidity

1. Pulmonary complications—7 cases	Cases
Pneumonia	5
Bronchitis	2
2. Infection of wound (in 192 laparotomies)	8
3. Induration about cervix	9
4. Pelvic hæmatoma	3
5. Phlebitis, femoral	2
6. Urinary vaginal fistula	1
7. Hæmatoma in wound	2
8. One wound broke open on sixth day (case of intestinal obstruction).	

Results in 22 cases were faulty. These may be detailed as follows:

In 3 cases the patient died after leaving the hospital. One patient developed intestinal obstruction after 4 months and died at operation in another hospital. Another died of peritonitis after removal of a painful cystic ovary left at hysterectomy. A third died in 4 months as a result of visceral carcinosis due to malignant ovarian cyst. This cyst complicated a hysterectomy for fibroid. Since it was adherent to the peritoneum, fragments of it were probably left.

There were 3 incisional herniæ. Two of these developed in cases with primary union of the wound. The other followed infection.

One patient had a urinary vaginal fistula which was operated upon in another hospital.

There were 4 cystic ovaries. One of the cysts developed after myomectomy and salpingo-oophorectomy for a serous cyst. The other ovary became cystic after 1 year. Two of the 4 cysts gave no symptoms.

There were 3 re-operations on the cervix. One was for suspected malignancy: disproved

[1] Read before the American Surgical Association, May 4, 1925.

by tissue examination. One re-operation was for bilateral laceration and 1 for laceration and erosion with leucorrhœa. These 2 cases would now be treated by cautery. In 2 cases there was pain in the side without apparent cause and in 1 case a tender mass in one fornix.

In two cases retroversion followed myomectomy. One of these patients complained of pain and frequent micturition and the other of sterility.

One patient was re-admitted to the medical wards for chronic endocarditis.

Another was re-admitted and operated upon for adhesions of the peritoneum.

The final faulty result was in a patient who complained of frequent urination.

In 3 cases full term pregnancies followed myomectomy.

In considering the problem of whether an ovary should be left when hysterectomy is performed, we analyzed 124 cases in which one or both ovaries were left. In 8 of these cases the remaining ovary was enlarged. Two of the ovaries had developed into good-sized, permanent, painless cysts, 4 to 6 inches in diameter. Two others were smaller but painful. Four of the enlargements disappeared in less than 6 months. In three cases the opportunity was presented at re-operation to examine the remaining ovaries. In each case they were firmly bound down by adhesions. This would suggest that difficulty may be experienced in removing a cystic ovary which has been left after hysterectomy, a feature which we have observed in other cases not in this series.

In a study made at the end of the first 5 years it was found that the surgical menopause was delayed and was less severe in cases in which ovaries were left. The results were best when the tube was left with the ovary.[1]

The symptoms of surgical menopause usually occurred within 3 months. The incidence and severity of the symptoms are indicated in the following table:

Cases examined at 3 months:		Symptoms of menopause:		
	Cases	Cases	Per Cent	
Both ovaries out.....	18	7	39	Severe in 6
One ovary in.....	40	7	17	Severe in 2
Both ovaries in.....	21	1		Not severe

[1] Hawks, E. M. Am. J. Obst. & Gynec., 1921, i, June.

The cervix was left in 159 cases. In no case did cancer develop in cervix. It was removed once when cancer was suspected, but it was negative. Twice the remaining cervix was removed because of old laceration. One of these cases had a persistent profuse leucorrhœa from erosion.

In most of the cases the cervix became smaller. Whether this atrophy was due to shrinkage following reaming out of the canal or to interference with blood supply is uncertain.

There was no case of prolapse of the cervix. Since the round ligaments were not sewed into the cervical stump in about one third of the cases, it is evident that this procedure is ordinarily unnecessary as a means of support for the pelvic floor. There is nothing cut which supports the cervix when a supravaginal hysterectomy is done; therefore, if the cervix is in good position it is likely to remain in good position. As Bissel states, tension by the round ligaments tends to draw the cervix toward the introitus of the vagina, an unfavorable position. Further, sewing the ligaments under tension into the cervical stump occasionally causes pain. Therefore, as a routine step, it appears to us best not to suture the round ligaments under tension into the cervical stump with the object of thus supporting the pelvic floor. They may, however, be used to advantage, without tension, as an aid in peritonealization.

In most of the cases the cervical stump was reamed out from above. This procedure does not remove the epithelium about the external os, which is the most common origin of carcinoma of the cervix. The reaming process simply removes part of the mucous membrane of the cervical canal. Its effect then is not so much to prevent malignancy as to afford easy approximation of the edges and to prevent excessive leucorrhœa in an infected cervical canal by removing a large proportion of the glands of the cervix. While we have seen two cases (not in this series) of cancer in a cervical stump, the occurrence is very infrequent and should not be the deciding argument for complete hysterectomy. Of course it must be recognized that some cases of extreme laceration indicate complete hysterectomy, but

these are rare. In doubtful cases the cervix may, if necessary, be subsequently removed from below or treated with cautery. This seems in general a wiser and safer procedure than a complete hysterectomy. The attachments of the cardinal ligaments at the sides of the cervix are thus left intact. In this way prolapse of the vaginal walls which sometimes follows complete hysterectomy is avoided. We have had no case of hæmorrhage from the cervical stump.

Conclusions. For fibromyoma the following procedures are apparently indicated: 1. X-ray treatment according to the rules of Clark of Philadelphia. 2. Myomectomy in young women when feasible. 3. In general supra-vaginal rather than complete hysterectomy. 4. Round ligaments ordinarily should not be attached to cervix under tension. 5. One or both ovaries should be left, preferably with their tubes.

CARCINOMA OF UTERUS

There were 45 cases of carcinoma of the uterus.

Five of the patients with cancer of the cervix were between 20 and 30 years of age; 11 between 30 and 40 years. This is a significant proportion of cases in young women. Five patients with cancer of the cervix had not borne children, thus eliminating laceration in these as an etiological factor. Radical abdominal hysterectomy was performed in 16 cases and vaginal in one, with 2 deaths; 12 were favorable cases. There were ureteral fistulæ in 2 cases and vesical fistulæ in 2. Three of the 4 fistulæ closed spontaneously. There were 4 infections. These results constitute a rather appalling reflection upon the radical operation or upon the way it was performed.

Of the 15 survivors of radical operation, 8 are known to have died of the disease, in 3 the result is uncertain, the patients being lost, in 4 the result was good, that is, three patients who had squamous-celled carcinoma of cervix have passed 8 years, 7 years, and 4 years, respectively, without evidence of recurrence. One patient with cancer of the body of the uterus died of nephritis 4½ years after operation and autopsy showed no recurrence or metastases. None of these long standing cases had irradiation. With cautery methods nothing seems to have been accomplished (13 cases).

Follow-up. Operative treatment was carried out in 13 cases of carcinoma of the cervix. The results are as follows: 1 postoperative death; 5 died within 1 year; 1 died within 3 years; 6 cases had no recurrence when last seen, 18 months, 2 years, 6 months, 2 years, 6 months, 4 years 3 months, 7 years, and 8 years after operation. Operation for carcinoma of the body of the uterus was done in 4 cases with 1 postoperative death, 1 death in 5 months, 1 death from nephritis in 4 years 7 months after operation but no recurrence, and 1 patient alive with no recurrence 1 year after operation.

No operation was performed or treatment given in 3 advanced cases and the patients died in 5,, 6, and 7 months respectively.

The Paquelin cautery were used in 4 cases with 1 operative death from peritonitis and death in 3 cases in 2⅔ months on an average. The Percy cautery was used in 3 cases and the patients died in an average 6⅔ months. The Percy cautery was used and the iliacs ligated in 3 cases with 1 operative death from shock and 2 deaths in an average of 9 months.

Radium alone was used in 4 cases and the patients lived from 5 to 18 months.

Radium and X-ray were used in 8 cases. Five patients died in 6 to 18 months and 3 were living when last seen 10 to 12 months after operation. The radium was administered in another clinic.

Conclusions. The analysis of our operative results and the observation of the results of radium treatment in the hands of others has led us in recent years to advise radium rather than operation for carcinoma of the cervix except in very early cases, a type unfortunately which we rarely see.

The limitations and shortcomings of a follow-up system are strikingly exemplified in this cancer series. Whereas practically all of the cases were followed for a variable time, most of the important ones were lost during the progress of years, and, of course, in cancer, it is only the long extended follow-up that counts. A special effort must be made to hold such cancer cases under observation; one

man should see the patients regularly, should gain their confidence and so conduct the clinic as to make the patients desire to come to him for advice.

RETROVERSION

There were 159 operative cases in this group as follows:

	Cases
Round ligament suspension (Gilliam)	118
Ventral fixation and suspension of uterus	19
Coffey operation (plication of round and broad ligaments)	15
Plication of round ligaments	4
External Alexander	1
Interposition of uterus	1
Vaginal shortening of uterosacral ligament	1

Longitudinal incisions were used in 70 cases and transverse incisions in 87 cases.[1]

There were 2 deaths, a mortality of 1.3 per cent. The first case was complicated by salpingitis. Salpingo-oophorectomy, appendectomy, and a Coffey operation were done. Death was due to peritonitis. The second patient died of pulmonary embolism on the sixth day after operation.

There were no postoperative herniæ. There were eleven pregnancies, one being complicated. This was a case of instrumental delivery and postpartum hæmorrhage after the Gilliam operation. There is no record of intestinal obstruction or of hernia following the Gilliam operation.

There was an interesting case in the group of Gilliam operations. Following operation for uncomplicated retroversion there occurred two successive ectopic pregnancies. It was thought that the tubes were partly occluded by being drawn into the openings made for the ligaments.

A summary of the results in this series of retroversion cases for the period 1915 to 1925, is as follows:

	Cases operated on	Cases followed 3 months to 7 years	Anatomically good		Symptomatically good	
			Cases	Per cent	Cases	Per cent
1915 to 1920	101	78	69	88	44	56
1920 to 1925	58	51	48	94	36	70

The following is a more detailed record of the follow-up results of the last 5 years:

[1] It is of interest to note that in this series of 962 cases there were 181 transverse incisions with 4 infections and 1 incisional hernia.

Of 58 cases operated upon 7 were lost sight of, leaving 51 cases which were examined and we found 35 cases which were judged "good" anatomically, symptomatically, and economically, and 16 which were judged faulty in one or more respects, as follows:

	Anatomically	Symptomatically	Economically	Operation
1	Good	Fair (leucorrhœa)	Good	Gilliam
2	Good	Fair (leucorrhœa)	Good	Gilliam
3	Good	Fair (backache)	Good	Gilliam
4	Good	Fair (backache)	Good	Gilliam
5	Good	Fair (leucorrhœa)	Good	Gilliam
6	Good	Poor (frequency of urination, backache)	Good	Gilliam
7	Good	Fair (frequency of urination)	Good	Gilliam
8	Good	Fair (nervous)	Good	Gilliam
9	Good	Fair (frequency of urination)	Good	Gilliam
10	Poor (retroversion)	Good	Good	Gilliam
11	Poor (retroversion)	Fair (frequent urination, backache)	Good	Gilliam
12	Good	Fair (backache)	Good	Gilliam
13	Good	Fair (backache)	Good	Gilliam
14	Poor (retroversion)	Poor (pain)	Poor (can't work)	Gilliam
15	Good	Fair (backache)	Good	Gilliam
16	Good	Fair (backache)	Good	Gilliam

SUMMARY

	Anatomically	Symptomatically	Economically
Good	48, 94 per cent	36, 70 per cent	50
Fair	..	13	..
Poor	3	2	1

Conclusions. The follow-up system has influenced our surgical treatment of retroversion. A summary of the cases was made at the end of 5 years. It was found that in 78 cases followed the results were anatomically 88 per cent good, but symptomatically only 56 per cent good. It was also found that the Gilliam operation had given the best results—91 per cent good anatomically and 64 per cent good symptomatically. This comparison, however, is of little value since other procedures were used infrequently. In the second 5 years it is striking that the number of operative cases has been reduced from 101 to 58. The orthopedic surgeons have been consulted more freely in an endeavor to determine whether other factors besides the displaced uterus might be the cause of symptoms such as backache, and more of the cases have been tested with pessaries before being referred for

operation. If the pessary has given relief, the cases have been referred for surgical treatment in the expectation that they might receive permanent benefit. In the second 5 years the results have improved so that in 51 cases followed, 48 have been anatomically good, 94 per cent, and 36 symptomatically good, 70 per cent. The Gilliam operation was done in 56 cases of the 58 cases.

SALPINGITIS (CHRONIC)

There were 225 cases of salpingitis, with no operation done in 30 cases, leaving 195 in which laparotomies were done (cases of colpotomy for abscess are not included). In these a longitudinal incision was used in 164 cases, the transverse in 31.

All of the operative procedures will not be enumerated in detail. The groups were in general as follows:

	Cases
Hysterectomy (in 6 both ovaries removed)	14
Salpingo-oophorectomy on one side with salpingectomy on other side	53
Bilateral salpingectomy, both ovaries left	32
Bilateral salpingo-oophorectomy	10
Unilateral salpingo-oophorectomy	32
Unilateral salpingectomy	20
Conservative operations	28
Unclassified	6

Unfortunately, it is not possible in this paper to discuss the etiological factors, nor the type and degree of infection.

Immediate results. There were 5 deaths in the hospital. The first patient died from peritonitis following salpingo-oophorectomy, the second patient died of peritonitis following supravaginal hysterectomy and bilateral salpingo-oophorectomy; a third patient died of peritonitis following bilateral salpingectomy for large abscess; the fourth and fifth patients died of pneumonia following supravaginal hysterectomy and bilateral salpingo-oophorectomy. There was a mortality of 2 per cent (3 of the deaths were in 14 hysterectomies).

Follow-up. Of 161 cases examined, 127 were judged to be in entirely good condition (79 per cent), leaving 34 cases judged to be in faulty condition. Of these we will cite only the more important groups, namely: 7 incisional hernias; 10 cystic ovaries; 5 cases had severe symptoms of surgical menopause; 3 cases of adherent retroverted uterus; 2 cases complained of pain in pelvis.

Fig. 1. Photomicrograph showing embryonal type of cells which in some respects resemble endothelioma.

There were 14 subsequent operations; five of these for bleeding. It is worthy of note that 3 patients became pregnant, 2 going to full term, 1 aborting.

The high mortality following hysterectomy, 3 in 14 cases, indicates the danger of such a radical procedure.

The fact that there were only 10 cystic ovaries in the large number left, indicates that there is little risk of trouble from conservatism, but 5 cases of severe surgical menopause in 16 bilateral oophorectomies, is a serious reflection on this radical procedure.

The follow-up shows few cases of trouble from leaving the uterus. Five patients required treatment for bleeding and 3 were found to have adherent retroverted uteri.

Subsequent operations. 1. Hysterectomy for bleeding 3 years after double salpingectomy.

2. Hysterectomy for bleeding fibrous uterus 4 years after bilateral salpingo-oophorectomy.

3. Removal of cystic ovary, difficult, 4 years after repair of fæcal fistula.

4. Repair of incisional hernia, 4 years after operation.

5. Repair of incisional hernia, 5 years after operation.

6. Dilatation and curettage for bleeding with X-ray treatment later and also operation for cystic ovary.

7. Dilatation and curettage for bleeding and X-ray treatment.

8. Operation for chronic intestinal obstruction and removal of cystic ovary.

9. Radium treatment of carcinoma of cervix, no operation.

10. Repair of incisional hernia.

11. Re-operation upon cystic ovary.

12. Operation for acute intestinal obstruction.

13. Hysterectomy for fibrous uterus and bleeding, 4 years after bilateral salpingo-oophorectomy.

14. Operation for intestinal adhesions, 2 years after salpingectomy.

SALPINGITIS (ACUTE)

There were 87 cases designated on discharge "acute salpingitis." They presented on admission acute symptoms, notably fever, pain, and tenderness. They include not only early infections but also chronic cases with exacerbation (the latter were in the majority). Twenty-one cases were not operated on (7 refused operation and in 14 operation was not advised).

Laparotomy was done in 63 cases in this group. The longitudinal incision was used in 58 cases, the transverse in 5. The following operations were done:

	Cases
Hysterectomy	0
Bilateral salpingectomy and unilateral oophorectomy	17
Single salpingo-oophorectomy	8
Bilateral salpingectomy	13
Single salpingectomy	8
Bilateral salpingo-oophorectomy	1
Salpingo-oophorectomy and resection of other tube	1
Bilateral salpingectomy and resection of one ovary	2
Bilateral salpingectomy and resection of both ovaries	1
Laparotomy—drainage of abscess	1
Laparotomy—nothing removed from pelvis—appendectomy	8
Laparotomy—nothing removed	2
Bilateral salpingectomy, single oophorectomy, other ovary resected	1
Post-colpotomy only	2

Other procedures:

	Cases
Appendectomy	35
Ventral suspension	4
Myomectomy	1
Dilatation and curettage	5

Abdominal drainage was used in 32 cases—in 13 extraperitoneal of the wound, in 19 extraperitoneal. Vaginal drainage was used in 22 cases.

Immediate results. One patient died, a mortality of 1.5 per cent. Death was from pulmonary embolism. Two patients had ileus. Both recovered. A high jejunostomy was done in one case. Three patients had pelvic abscesses.

Follow-up. Of the operative cases 48 were examined. Of these thirty-seven were judged to be entirely good and ten faulty. There were really 11 faulty cases (judgment in 1 case was deferred). These 11 cases include 5 incisional hernias, 2 cystic ovaries, 1 adherent retroverted uterus, 1 atresia of vagina due to posterior colpotomy drain, 1 case of pain in pelvis.

Conclusions. From the combined groups, acute and chronic salpingitis, the following conclusions may be drawn:

1. Hysterectomy gives a relatively high mortality. This radical procedure should therefore in general be avoided.

2. Preservation of the uterus rarely causes symptoms, thus, 5 cases only suffered from bleeding and 4 from adherent retroverted uterus.

3. The follow-up analysis of the series of cases of acute and chronic salpingitis shows only 12 cystic ovaries in the large number of ovaries that were left.

This indicates that conservation of ovaries rarely occasions trouble. On the other hand there were 5 cases of severe surgical menopause in 17 cases in which both ovaries were removed (this included 6 hysterectomies). It is, therefore, important that one or both ovaries be conserved.

4. Careful follow-up should lead to the recognition of complications at an early date.

TUBERCULOUS SALPINGITIS

There were 19 cases of tuberculous salpingitis.

In 7 cases 1 tube was removed; in 11 both tubes. The appendix was removed in course of operation in 7 cases.

The operator realized that he was dealing with a tuberculous lesion in only 7 cases. This undoubtedly accounts for the preservation of one tube in some of the cases. One case was treated by panhysterectomy and died on fifth day.

Follow-up.

Time followed
1 case 5 years.
1 case 3 years 2 months.
1 case 2 years 6 months.
1 case 2 years 4 months.
1 case 2 years 5 months.
1 case 2 years 3 months.
1 case 22 months.
1 case 20 months.
1 case 19 months.
3 cases 16 months.
1 case 13 months.
1 case 10 months.
1 case 7 months.
1 case 6 months.
1 case 5 months.

In 11 patients the result is entirely good to date; in 6 it is faulty. Of the 6 faulty cases 2 developed tuberculosis of the urinary tract; 1 had nephrectomy at 5 years; 3 cases died of tuberculosis of lungs or elsewhere, in an average of about 18 months after operation; in 1 there was a persistent abdominal sinus.

Conclusions. 1. If left these cases would presumably develop into generalized tuberculous peritonitis.

2. Early removal of affected tube seems to promise well for the limitation of the local process, although it is obvious that our cases have not been followed sufficiently long to carry much weight as to the ultimate outcome.

3. There is no reason to believe that the tuberculous process begins simultaneously in both tubes but certainly there is a tendency for both tubes to become involved; therefore, while it is not mandatory to remove the apparently unaffected tube, it is probably safer to do so, although all features of the case must be weighed carefully in the decision.

ECTOPIC GESTATION

There were 93 cases of ectopic gestation. Of these 4 were operated upon the second time for ectopic gestation in the remaining tube, making a total of 89 patients in the series.

On admission to the hospital 24 cases were in collapse, and 69 were in good or fair condition. After operation transfusions were carried out in 2 cases, infusions in 16 cases and hypodermoclyses in 2 cases.

Diagnosis was correct in 68 per cent of the total number of cases; correct in 100 per cent of cases in collapse. Errors of diagnosis are shown in the following table which gives the number of times that ectopic gestation was diagnosed as some other lesion and also the various conditions that were wrongly diagnosed as extopic gestation.

In a total of 93 cases, ectopic gestation was wrongly diagnosed as:

	Times
Salpingitis or tubo-ovarian abscess	10
Pelvic abscess	3
Ovarian cyst	3
Incomplete abortion	3
Appendicitis, acute	5
Fibroid	3
Cervical polyp	1

Other conditions wrongly diagnosed as ectopic gestation:

	Cases	Times
Salpingitis or tubo-ovarian abscess	262	11
Pelvic abscess	37	2
Ovarian cyst (tumor)	129	5
Incomplete abortion	148	2
Nothing (exploratory)	...	1

Ninety-three laparotomies for ectopic gestation were done in 89 patients, with 2 deaths; one in a patient in collapse and the other of peritonitis in a patient with an old infected ectopic sac.

Follow-up. Of 87 patients, 72 were examined and 9 others were heard from through letters or the Social Service, making a total of 81 (94 per cent) followed and 6 lost. Four patients had a second ectopic gestation. Ten patients have had normal pregnancies.

Postoperative hernia followed infection in 1 case.

The results were all good except in 2 cases. In 1 the result was fair, with a mass in the pelvis; in the other the patient had a hernia from a grade A. infection.

Conclusions. In ectopic gestation when the patient is in collapse, it has always been our practice to operate as soon as possible after

admission to hospital rather than delay as has been advocated by some. Morphine is administered. Fluids are withheld until the abdomen has been opened and hæmorrhage controlled. The low mortality, 1 in 24 cases, indicates that this should be the procedure of choice; that is, active hæmorrhage should be arrested with the least possible delay.

OVARIAN CYSTS AND TUMORS[1]

There were 230 cases of ovarian cyst and tumor. In 133 the ovarian condition was the dominant lesion. In 97 it was an associated condition, as a rule a follicular cyst.

The 133 cases were classified as follows:

		Cases
Parovarian cysts	..	5
Ovarian tumors and cysts		
Simple serous cysts (so called follicular)	..	51
Corpus luteum cysts	..	14
Cystadenomata		
Pseudomucinous		
Everting (common type)	11	..
Inverting (papillary, rare)	2	13
Serous		
Everting (rare)	0	..
Inverting (common)		
With true papillæ	6	..
Superficial papilloma of the ovary	1	..
With connective tissue excrescences on inner surface	6	13
Cysts (for various reasons nature undetermined), strangulation, gangrene, faulty specimen	..	8
Carcinomata		
Papillary cystadenocarcinoma	3	..
Carcinoma of other nature		
Embryonal carcinoma (alveolar sarcoma)	2	..
Primary solid carcinoma	1	..
Medullary carcinoma	1	..
Dermoid (squamous) carcinoma	1	..
One case (clinical diagnosis only—no operation)	1	9
Teratoid tumors		
Dermoid cysts	15	..
Teratomata	3	18
Fibromata	..	2

The simple cysts were the most numerous. Some of these cysts were large and apparently important growths. They often had an epithelial lining of non-ciliated flat or cuboidal cells. They were rated, nevertheless, as simple cysts. Their histogenesis, however, is disputed.

The simple cysts also comprised almost the whole group of tumors associated with more important lesions. They furnish evidence as to the outcome in resection of the ovary. Forty-eight cases with a resected ovary were followed. In 40 cases the result was good. In 8 cases the resected ovary was temporarily enlarged. In one case re-operation was done for a painful cyst.

The parovarian cysts were not noteworthy. Four were followed. Results good.

Of the pseudomucinous cysts, 11 were unilateral and 2 bilateral. Both of the bilateral cases were also papillary and in each case both ovaries were removed. There were no deaths in this group. Eleven cases were followed on the average—2 years and 3 months. There were no recurrences.

Among the serous cystadenomata were found a number of adherent tumors—some of them intraligamentous. These cysts have ciliated cells and tend to "invert" in contradistinction to pseudomucinous cysts.

In true papillary cysts of whatever type there is a tendency to bilateral occurrence. Papillary cysts are prone to give rise to peritoneal implantations. These may continue their autonomous growth after the ovarian cyst has been removed. Therefore, on account of the possibility of bilateral occurrence and peritoneal implantations it has been our rule in all true papillary cysts to remove the second ovary as a prophylactic measure.

By true papillæ is meant epithelial proliferations in contradistinction to connective-tissue projections covered with a single layer of epithelial cells. Our group of serous cystadenomata presented these two types in equal number. The relation of these two types remains undetermined, as does the significance of the connective-tissue projections.

There were nine carcinomata, including several varieties. The most common form was the papillary cystadenocarcinoma. There were three of these and all of them died within a year after leaving hospital. There were two embryonal carcinomata formerly known as alveolar sarcoma or round-cell sarcoma. Both patients died within a year. There was one squamous-cell carcinoma, originating in a dermoid. This patient died 4 months later of peritoneal carcinosis. One patient with a solid primary carcinoma died 4 days after

[1] The pathological material of all of these cases has been reviewed recently by Dr. Elser and Dr. Semsroth of the New York Hospital.

operation. One case was classified as medullary carcinoma and the patient is alive and free from recurrence at 7 years. The tumor was unilateral and consisted of a large non-adherent cyst containing brownish serous fluid. The wall had a smooth internal surface, except for a low elevation, ½ inch by 2 inches by 3 inches. This thickening consisted of a carcinomatous growth. The cells appeared embryonal in nature and in some respects the growth resembled an endothelioma (Fig. 1). The patient was 25 years old. The other ovary was left and to date has not shown recurrence.

Of the 15 dermoid cysts, 2 only were bilateral and 13 unilateral. There was one death from peritonitis. Of the unilateral cases the other ovary was left in 12 and these patients were followed on the average of 23 months without apparent change in the other ovary.

There were 3 teratomata. All of them in girls of 20 years of age. The other ovary was normal and left in each case. One has been followed 1 year and the other two each 3 months without evidence of metastases or recurrence.

Conclusions. Conservative treatment of follicular and corpus luteum cysts is satisfactory.

Irrespective of the type of cyst, it is advisable to remove both ovaries when true epithelial papillæ are found on one side.

LEVATOR CERVICIS UTERI

By F. G. DuBOSE, M.D., F.A.C.S., Selma, Alabama

ANATOMY

THE structure, to which attention is called, in the female is the prototype of the levator prostatæ in the male. It has either escaped the anatomists' attention, or has been dismissed with the terse description that the anterior fibers of the levator ani muscle descend upon the sides of the vagina. In the male the anterior fibers from the levator ani muscle descend upon the sides of the prostate gland and unite beneath it with the same muscle of the opposite side, supporting the prostate as a muscular sling. Some anatomists describe it as a distinct muscle under the name of the levator prostatæ. Careful dissection in the female will demonstrate the same arrangement of muscle fiber fusing with its fellow of the opposite side over the upper end of the vagina and the cervix uteri, forming a sling for the cervix uteri on its anterior or under surface, when it is normally anteverted. Furthermore, these fibers are as distinct on the surface of the cervix in the female as on the prostate in the male. This muscle arises from the os pubis, with the puborectalis, follows its course backward and internal to it along the sides of the vagina converging over the anterior vaginal fornix and anterior surface of the cervix, is inserted into the anterior surface of the cervix at the isthmus, and fuses into the median aponeurotic raphé with the fibers of the same muscle of the opposite side. This median raphé is a strong fibrous or aponeurotic band, extending throughout the midline portion of the uterovesical attachment. On either side of this median raphé the

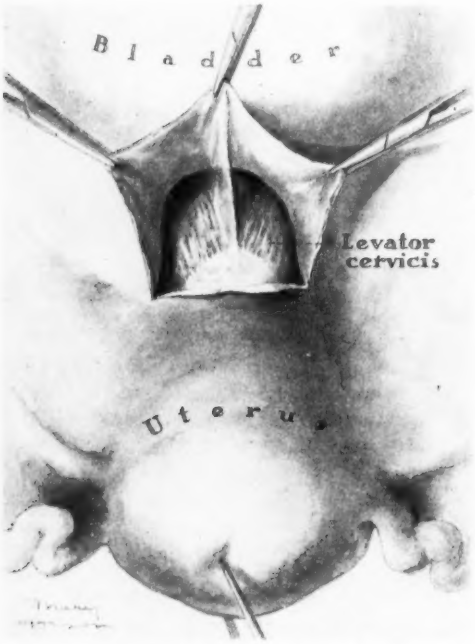

Fig. 1. The uterovesical plica has been incised exposing the levator cervicis.

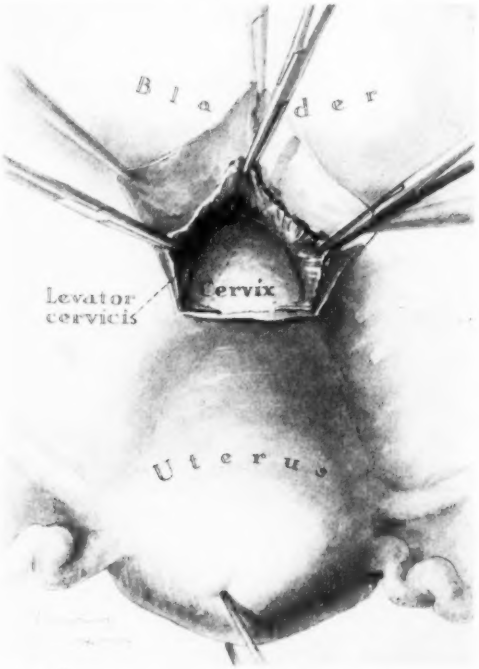

Fig. 2. The levator cervicis has been removed exposing the cervix.

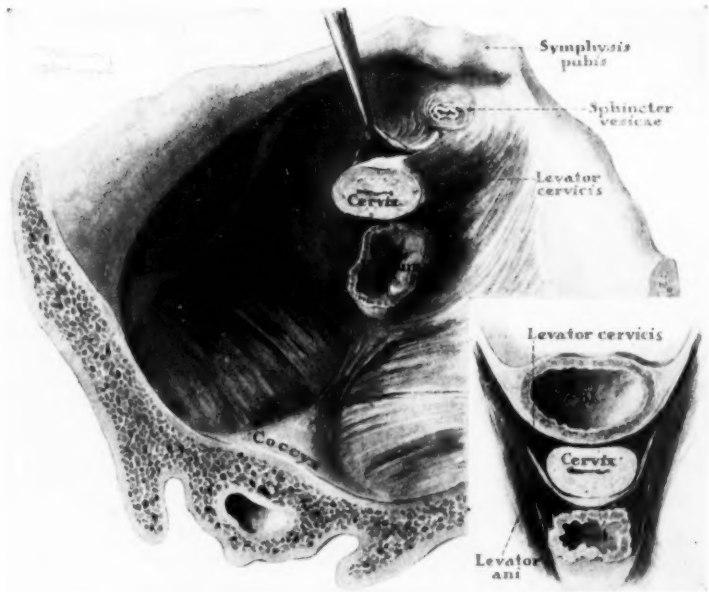

Fig. 3. Sagittal section showing relation of levator cervicis uteri to surrounding structures.

connection between the uterus and the bladder is of loose areolar tissue and easily separated by blunt dissection in the lines of cleavage. Not so with the median attachment, which is dense and firmly adherent, holding the base of the bladder in a longitudinal line firmly attached to the cervix uteri. This portion is separated with difficulty by blunt dissection, and in the operation of hysterectomy is usually cut with scissors. The fibrous band of attachment between the bladder and uterus begins approximately 1 centimeter below the isthmus, portiosupravaginalis, and extends downward and below on the vagina at its reflection on the cervix and between the vesicovaginal attachment.

SURGICAL ANATOMY

After the uterovesical plica of peritoneum is incised, and blunt dissection of the bladder from the cervix uteri is begun, it is found that lateral to the midline the dissection is easy, the lines of cleavage being loose. In the midline, the fibrous connection is dense and closely adherent between the bladder and the cervix uteri. So difficult frequently is blunt dissection in this area that it becomes necessary to incise this raphé. As a matter of fact, it is always better after the dissection is done bilaterally to lift up this midline and cut the adherent tissue with scissors. As soon as this is done, the bladder is readily pushed forward well beyond the cervicovaginal junction. An incision is made with the knife 2 millimeters in depth and a half centimeter below the cut edge of the peritoneum (which point is immediately below the isthmus), and carried transversely across the cervix. From this point, blunt dissection will push downward and forward a second layer of tissue off the anterior surface of the cervix to a point on the anterior vaginal wall from 1 to 2 centimeters below its reflection on the cervix. Lift up this band of tissue, spread it out over the handle of a knife. Examination will prove it to be muscular fibers which extend into and fuse with the levator ani muscle. They are its anterior fibers and form in the female the same sort of a sling for support of the cervix uteri that they do in the male for the prostate gland.

DEPARTMENT OF TECHNIQUE

RIGHT URETERAL OBSTRUCTION DUE TO SHORT CÆCAL MESENTERY

By THOMAS N. HEPBURN, A.M., M.D., F.A.C.S., Hartford, Connecticut

THERE is a group of cases giving a history of right renal colic following indiscretion in diet and intestinal distention, which has perplexed me for some time. During the ordinary examination with the cystoscope, ureteral catheter, and roentgen-ray, the pain can be reproduced by distention of the renal pelvis. The ureterogram will show moderate dilatation above the brim of the skeletal pelvis. Occasionally this dilatation is marked with the usual drain trap formation opposite the lower pole of the kidney. Surgical exploration of the ureter at the point where the dilatation begins, if made by the usual retroperitoneal route, will reveal nothing to explain its cause. The

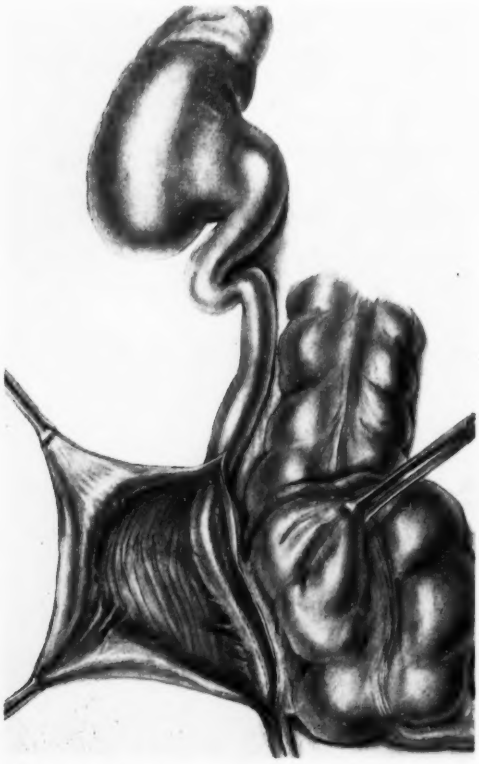

Fig. 1. Trendelenberg position. Abdomen opened through right rectus incision. Cæcum pulled over toward mid line. Ureter explored by incision through the post-parietal peritoneum down to area of constriction.

Fig. 2. The ureter has been transplanted to the lateral abdominal wall; thus the drain trap of the upper end is removed. The cæcum is mobilized by freeing its mesentery.

Fig. 3. Ureter stitched in its new location so that all slack and kinks are removed.

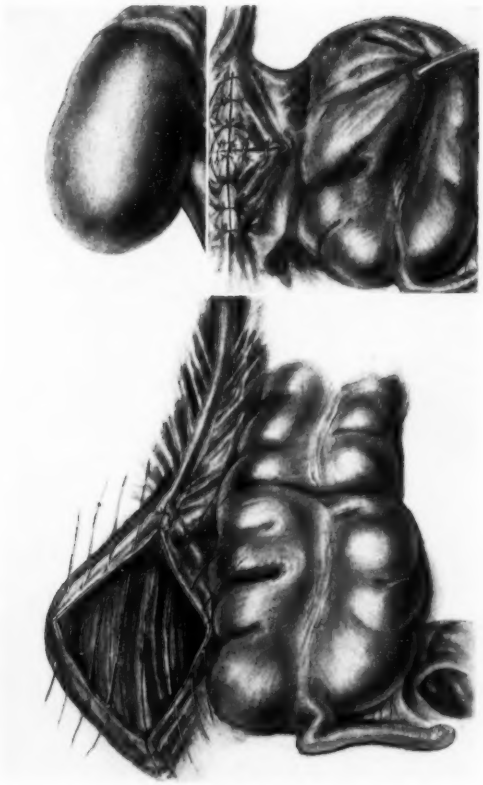

Fig. 4. Showing method of suturing parietal peritoneum over ureter and elongating the cæcal mesentery.

point of transition from normal ureter to dilated ureter is found, but there are no periureteral adhesions, no thickening of the ureteral wall, or sign of stricture, and no mass pressing on the ureter, to be palpated through the peritoneum.

After several fruitless extraperitoneal explorations, I began to explore transperitoneally through a right rectus incision, and became impressed with the immobility of the cæcum, due to a short mesentery. The ureter when exposed by a longitudinal incision through the posterior parietal peritoneum was found to be dilated down to a point just opposite the cæcum. Traction on the cæcum would cause a pull and kink of the ureter, greatest at the point of beginning dilatation. The mechanics of the intermittent ureteral obstruction could then be easily visualized.

Here we have a type of anatomy which allows perfect ureteral drainage under ordinary bowel conditions, but as soon as the cæcum becomes unusually distended by gas as a result of indigestion, the short mesentery is put on a strain. This kinks the underlying ureter, causing distention of the ureter above and the pain in the kidney.

In an effort to correct this condition, I have found the following operation simple and effective in the 2 cases in which I have tried it. The illustrations carry with them a description of the technique (Figs. 1, 2, 3, and 4).

Both patients operated upon had had appendectomies, so they were familiar with postoperative pains. Following the previous operations the postoperative abdominal distention had accentuated the pain for which they sought relief. Following the operation I have described, they both volunteered the information that the pain had been relieved. In 1 case, 8 months, and in the

other, 3 months have elapsed with no return of symptoms, even with considerable intestinal distention with gas.

CONCLUSIONS

Right ureteral obstruction may be caused by indigestion with cæcal distention, if the cæcal mesentery is so short that when the bowel gets ballooned up with gas, it pulls on and kinks the underlying ureter.

The operation of transplanting the ureter laterally so that it no longer runs under the cæcum together with mobilization of the cæcum, has given relief from symptoms in 2 cases.

A GUILLOTINE FOR DIVIDING THE FIRST RIB IN PARAVERTEBRAL THORACOPLASTY

By HOWARD LILIENTHAL, M.D., F.A.C.S., New York

THE operation of paravertebral thoracoplasty in tuberculosis and in certain suppurative pulmonary diseases cannot fail to become rapidly popular in the United States. The excellent results which have been attained in short periods of time will impress phthisiologists particularly, with the great value of this surgical procedure as an adjunct in a large percentage of otherwise hopeless cases. The operation is one which requires excellent judgment and in which the co-operation of phthisiologist and surgeon is imperative. Its technical difficulties are not great excepting those connected with the resection of the first rib. Here, however, the responsibility is particularly grave and the necessity for a high degree of skill is indispensable. There are three structures the integrity of which is threatened by the least slip in operative technique. They are the dome of the pleura, the subclavian vessels, and the brachial nerve plexus. It need scarcely be pointed out what a catastrophe would follow even the slight wounding of the vascular structures while comparatively little manipulation of the plexus may be followed by prolonged pain and disability.

The first rule is to peel away the periosteum with great care; the second is to protect the vessels and nerves from possible injury by the instrument used for dividing the rib.

Various forms of rib-cutting shears have been devised for this purpose the best of which is Sauerbruch's, but all of the instruments of this type have a tendency to lose their accuracy of adjustment. Besides, in using them there is a disagreeable twisting and wrenching sensation experienced by the subject under local anæsthesia—and local anæsthesia is almost mandatory in operations upon these patients.

The instrument here presented was made by Tiemann after my design. It does not operate on the principle of the shears but on that of the guillotine, a heavy osteotome being forced by a powerful screw toward an unyielding metal stop which forms the beak of the instrument. The drawing explains the instrument more clearly than a verbal description.

MODE OF APPLICATION

The first rib lies with its flat planes nearly horizontal and its borders anterior and posterior. It is the intention to cut this bone through its entire breadth from behind forward—not from above downward. Having denuded the rib of its periosteum beginning at the back, an aneurism needle or a bent probe is passed around the bone and worked toward the patient's shoulder and back again to make sure that a sufficient length of the thin edge of the rib has been bared. The osteotome having been screwed back far enough to make room for the rib between it and the beak, the guillotine is now placed in position with the beak against the deeper (anterior) edge of the rib. Once in place the structures in front of the rib are fully protected from injury. The guillotine is then pushed away from the median line of the body, and the bone divided by slowly screwing the chisel home. This is accompanied by no

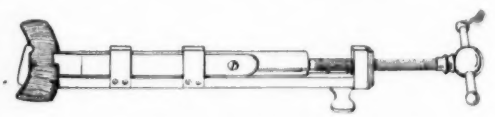

Fig. 1. Guillotine for cutting first rib. The picture illustrates how the osteotome cuts the rib at right angles to its edges.

pain and the motion being very gradual there are no sudden wrenches or twists to alarm the patient. The great power exerted by the screw permits a slow, steady passage through the bone. The guillotine is then shifted toward the spine as far as may be desirable and the bone again divided. The loose piece of rib is extracted with forceps. It is absolutely necessary that the first section should be the more distal to prevent the unsteadiness which would result if the rib were held by its anterior attachments only, after having severed it near the spine.

It will be noted that the edge of the chisel is stopped a fraction of a millimeter before it reaches the beak. This is to guard the edge from metallic contact.

I have tested this instrument thoroughly and it has never disappointed me.

A LIVER PACK FOLLOWING CHOLECYSTECTOMY FOR ACUTE CHOLECYSTITIS

By ROBERT L. MASON, M.D., Boston, Massachusetts
From the Lahey Clinic

THE question of drainage following cholecystectomy has not as yet been settled. However, in most clinics, some form of drainage to the cystic duct and gall-bladder fossa is used. In cholecystectomies for chronic cholelithiasis and cholecystitis, where it is possible to adequately peritonealize the severed cystic duct and the denuded fossa in the liver, rubber dam, or in less dry cases, a cigarette drain suffices.

In cases of acute cholecystitis in which a gall bladder with thickened and friable walls is removed from the fundus downward, there is no opportunity to save flaps for later peritonealization of the denuded area. An extensive oozing area in the liver bed is inevitable. A cigarette drain is inadequate because it cannot be made large enough to fill the area, and the absorbing, hæmostatic end is limited to a small area in the region of the ducts. Occasionally a gauze is applied to the gall-bladder fossa in addition to the cigarette. This is later removed with difficulty. Adhesions of the pylorus to the gall-bladder fossa are very apt to follow the use of such a drain.

The method of drainage in such cases as used in this clinic is as follows: After the removal of the gall bladder, one or two sponges are spread out to fill the denuded area in the liver bed left by the enucleation of the gall bladder. These extend from the stump of the cystic duct below, well beyond the upper surface of the liver (Fig. 2). A sheet of rubber dam is then spread over the gauze, reaching beyond the denuded area on each side for about 2 inches (Fig. 3). At the level of the peritoneum, the rubber dam is wrapped around the gauze and tied, after the manner of making a cigarette drain (Fig. 4). In this way, the ooze in the liver bed is well taken care of, leakage of the ligated cystic duct guarded against, and the possibility of adhesions to the surface of the liver is

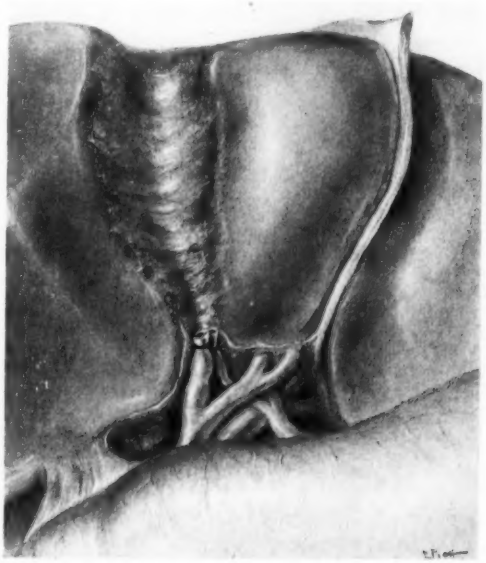

Fig. 1. Denuded area in liver bed following removal of gall bladder.

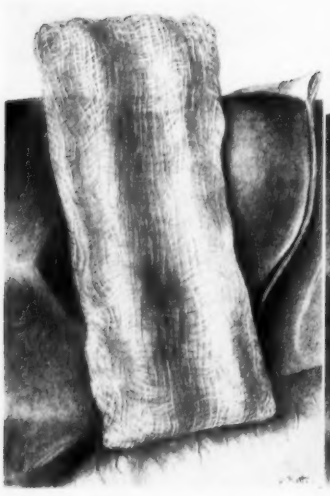

Fig. 2. Gauze applied to denuded area.

Fig. 3. Sheet of rubber dam applied over the gauze.

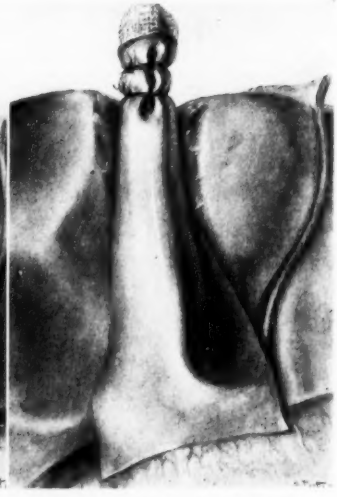

Fig. 4. Showing the drain when completed.

lessened. The drain is painlessly removed, as an ordinary cigarette, on the ninth day. The accompanying illustrations show the steps in the making of the drain.

CORRESPONDENCE

OIL STERILIZATION OF EDGED INSTRUMENTS

To the Editor: Through an oversight on our part credit was not given to Dr. Leland S. McKittrick of Boston for his co-operation with Mr. Leo Pelkus in developing the oil sterilizer described under the title of "Oil Sterilization of Edged Instruments," in SURGERY, GYNECOLOGY AND OBSTETRICS under date of August, 1925. We wish to take this opportunity to correct the above oversight, and to acknowledge Dr. McKittrick's assistance to Mr. Pelkus.

FRANK LAHEY.
Boston, Massachusetts. ROBERT L. MASON.

COMMONWEALTH FUND OF NEW YORK AND RURAL HOSPITALS

To the Editor: With the purpose of improving rural medical nursing and hospital care, the Commonwealth Fund of New York is offering to assist in the building of one hospital in a rural section. Certain conditions are laid down governing the distance from existing hospitals, the number of physicians to constitute the staff of the hospital, the character of the highways and transportation lines, and the willingness and ability of the community to defray deficits from operation. The Fund offers to pay two-thirds of the cost of construction and equipment.

If the experience in building one such hospital seems to warrant an extension of the program, the Fund will consider making a like offer to other districts needing a hospital. Applications are now being received and considered. It is probable that a decision as to the first unit will be made in the early fall.

HENRY C. WRIGHT. M.D.,
Consultant on Rural Hospitals.

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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WILLIAM J. MAYO, M.D. ..... Chief of Editorial Staff

DECEMBER, 1925

THE NOMENCLATURE OF SKIN GRAFTING

IT is essential when describing any surgical procedure to employ a standardized nomenclature so that there will be little if any chance of confusing the reader. A glance at various text books and at special articles on skin grafting will show that there is little uniformity in the descriptive terms used by the various authors when writing on this subject and a suggestion on the matter may be timely.

In the first place, the distinction between a flap and a graft is apparently generally misunderstood. A *flap* is a mass of tissue which is attached at some portion of its periphery or base by a pedicle through which it receives its blood supply, and which can be shifted only so far as its pedicle will allow.

A skin flap is made up of the whole thickness of the skin with as much subcutaneous tissue as is required.

A *graft* on the other hand is a mass of tissue which is cut free to be transplanted where desired and which receives its blood supply from the surface on which it is placed.

A skin graft consists of either the whole thickness or a portion of the thickness of the skin, with no subcutaneous tissue. Hence it can be seen that a flap and a graft are not synonymous terms.

At one time, I included pedunculated skin flaps in the group with whole thickness grafts, but have since come to the conclusion that this is not correct, and that on account of the difference in the surgical procedures, indications, blood supply, and results, flaps and grafts should be considered as entirely separate entities.

Thus such terms as tube graft, pedicle graft, flap graft, which definitely signify flaps and not grafts should not be listed as grafts.

How to designate the source from which the grafts are obtained also seems to be a matter of considerable difficulty. I use the terms *autograft*, a graft obtained from the patient himself; *isograft*, a graft obtained from another individual of the same species; *zoograft*, a graft obtained from a lower species; and prefer these, since the older terms homograft and heterograft are frequently confused.

Well established types of grafts should also be correctly named, but anyone who is familiar with the proper designations is aware that in many instances, this is not the case. For example, there is considerable confusion as to the difference between the true Reverdin graft and the "small deep graft." The best way to settle the matter is to define what each type of graft is and then to mention some of the mistakes. Reverdin's description on December 15, 1869, of his own "greffe épidermique" is as follows:— "j'enlevai avec la pointe d'une lancette, au bras droit du malade, deux petits lambeaux d'épiderme, en ayant

soin de raser autant que faire se pouvait le derme sans l'entamer." In 1872, he revised his description of what he still called "greffe épidermique" thus: "C'est que tout démontre que dans le lambeau transplanté composé de tout l'épiderme et d'un peu de derme." Further on he says: "Pour ma part plusieurs greffes ont varié en étendue de 2 à 4 on 6 mill. carrés; j'ai toujours tâché de me rapprocher le plus possible de l'épiderme et de n'enlever que fort peu de derme."

From this it can be seen that Reverdin described the graft, which is named for him, at first as a pure epidermic graft and later found that it consisted of the epidermis and a very thin layer of the corium. In other words, it was the thinnest graft that he could cut.

In 1914, I described grafts of about the same size as the Reverdin graft, but differing in that they included practically the entire thickness of the corium, and these, I called "small deep grafts," which title has been generally accepted. These grafts differ from Reverdin grafts as much as whole thickness grafts differ from Ollier-Thiersch grafts and should not be confused with the thin Reverdin grafts.

Both Reverdin and "small deep grafts" are occasionally called "pinch grafts" because at one time Reverdin grafts were obtained by pinching up a bit of skin with forceps and cutting it off with scissors. This method has been abandoned as it caused unnecessary trauma to the graft, and it follows that the term "pinch graft" should also be discarded.

In a recent paper Reverdin grafts are described as "minute plugs of full thickness skin." Others also evidently unfamiliar with what the true Reverdin graft is, use the title "Reverdin graft" and describe "small deep grafts."

The large Ollier-Thiersch graft is very thin and may be compared in thickness with the true Reverdin graft. It consists of the epidermis and as thin a film of the corium as can be cut.

Not so long ago an author in a paper on Thiersch grafts said "if, after cutting, the graft seems too thick, the excess fat may be removed by trimming its under surface with curved scissors," which of course, indicates that if fat was present in these cases, he was actually dealing with whole thickness grafts, inasmuch as no ideally cut Ollier-Thiersch graft should go deeper than the outer portion of the recticular layer of the corium.

The whole thickness (Wolfe-Krause) graft consists of the entire thickness of the skin (epidermis and corium) down to the subcutaneous tissue.

In view of what skin grafts actually consist of, it does not seem rational to divide them into dermal and epidermal types, as there is no graft which is truly epidermal, unless we use the epidermal film over a blister. It is impossible to cut from the normal skin, with any apparatus now available, a pure epidermic graft. The microscope shows that even the thinnest Reverdin grafts and the most skillfully cut Ollier-Thiersch grafts contain a portion of the corium, thus eliminating the term epidermic and making the term *thin* more desirable. Consequently, it also seems wise to drop the term dermal and use the term *thick* for "small deep grafts" and grafts of the whole thickness of the skin.

Therefore, I again propose that skin grafts be divided into two general types—*thin* grafts and *thick* grafts.

In the *thin* graft group should be placed the original small thin Reverdin grafts and the larger grafts (Ollier-Thiersch) of the same thickness. In the *thick* graft group belong "small deep grafts" and whole thickness (Wolfe-Krause) grafts.

JOHN STAIGE DAVIS.

THE PRESENT STATUS OF ARTHROPLASTY

SURGERY, until the present decade, has offered no relief to those afflicted with ankylosed joints, though efforts have been made for over 100 years to re-establish motion by operative procedures. This has been due in part to the limited experience of the surgeon, who could not induce many to submit to operation when the chance of success was so slight, and as the number operated upon by any one surgeon has been usually small and followed by recurrence, there have been few advocates. Therefore statistics compiled from many and varied sources are not conclusive. Many problems have been elucidated by animal experiments in medicine and surgery, but in bony ankylosis of joints such measures are of absolutely no value, for it would be difficult to produce ankylosis in animals and impossible to obtain intelligent co-operation in the re-establishment of active motion, which is positively essential. Consequently, progess in this field has been achieved on the human subject by comparatively few surgeons in Europe and America. These experiments have been justifiable as a majority of ankylosed joints are in malposition and would be benefited by correction of the deformity even should mobilization fail; besides the operative risk is almost negligible, and the poorest end-result could only terminate in recurrence of the former state.

The reconstruction of an ankylosed joint is divided into two stages: first, a highly technical operative procedure which has been designated "arthroplasty," and second, a rigid and persistent routine after-treatment.

Arthroplasty not only prevents fusion between the bony surfaces, as was the sole object of the early or inexperienced operators, but restores the synchronous physiological action of all the component parts, as the muscles, fascias, ligaments, etc., which constitute the function complex of a normal joint. Wide excision of bone in the upper extremity may produce motion, but at the expense of stability; it is merely a haphazard method of inducing pseudo-arthrosis and should occupy no place in the surgery of ankylosed joints. Therefore, excision should not be confused with arthroplasty. The goal must be the attainment of a joint that is stable, strong, and durable, for unless this can be accomplished a stiff joint in the most advantageous position is far more desirable.

As with all innovations in surgery there is some difference of opinion as to operative technique but more regard should be given to reproducing normal function than anatomical detail. An interposing tissue should be inserted between the articular surfaces, with the exception of the jaw and possibly the wrist. An autogenous transplant of free fascia lata can be obtained without additional risk and has been found desirable with a majority of operators.

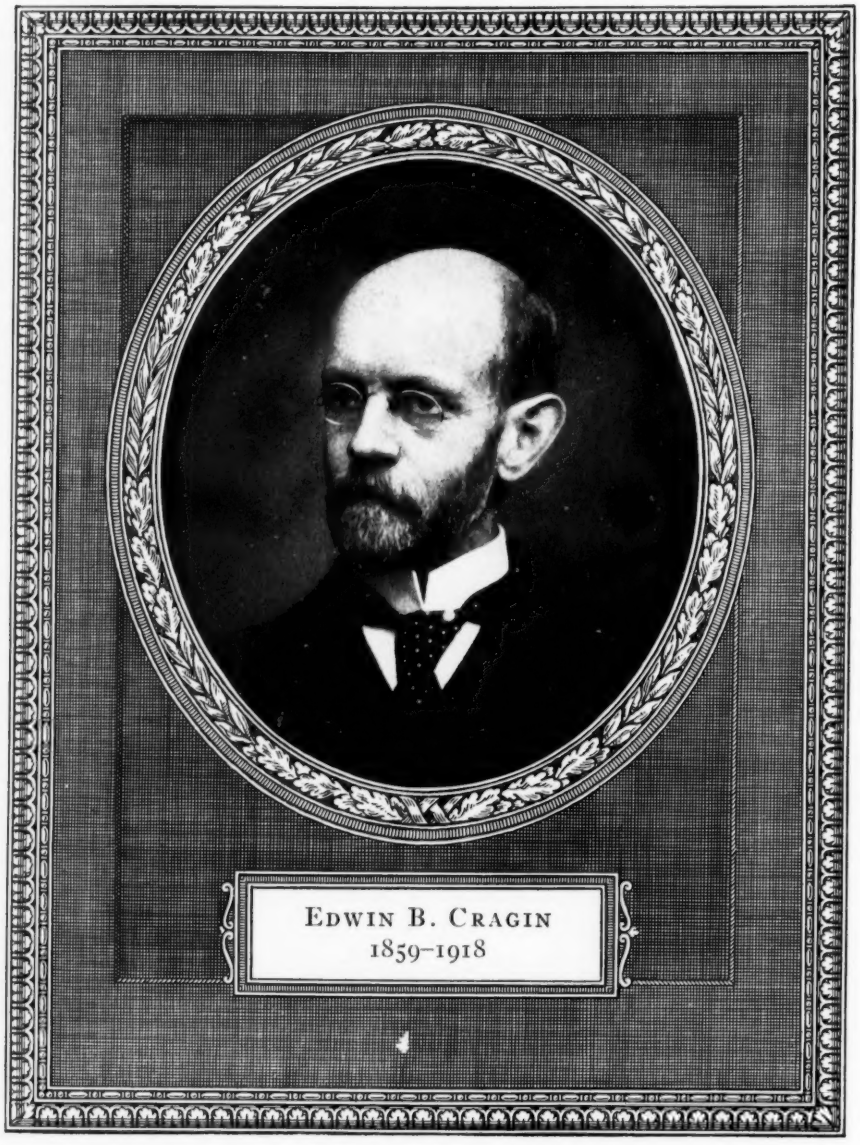
The operative technique fails unless it is followed by an efficient and continuous after-treatment, for which intelligent co-operation of the patient is essential and can be secured in the average individual without difficulty. Fortitude and endurance are not required to an abnormal degree as seems to be the prevailing opinion. Active and passive motion is given through the aid of special apparatus, adapted to the requirements of each joint, but under the direct control of the patient. Motion is thus gradually restored, with very little pain. Function must always be cultivated, not forced. Expert physiotherapy is an excellent but expensive adjunct and by no means essential; consequently, the treatment is available to all regardless of financial status.

The scope of the procedure, as well as the percentage of successful results, increase with

the experience of the surgeon, though care must always be exercised in the selection of cases. There are certain well known contra-indications, especially ankylosis as a sequela of tuberculosis, which should be emphasized in any discussion of the subject. In fact, surgical operations for the purpose of mobilization are rarely, if ever, permissible except when ankylosis has been caused by trauma or acute infections. Fortunately, the latter is the etiological factor in the majority of ankylosed joints.

The best results are secured in young adults and very rarely is arthroplasty indicated above the age of 45, though all depends on the stamina of the individual. At present, the operation is contra-indicated in children, as there is danger of injury to the epiphyses and it is difficult to secure co-operation in the after-treatment. The problem is more complicated in weight bearing joints, but the object and principle is identical in all joints. The four most favorable joints for arthroplasty are the jaw, elbow, knee, and hip. All ankylosed elbows, with few exceptions, should be mobilized. An ankylosed jaw compels social ostracism and is a menace to life from persistent oral sepsis, therefore, the operation may be considered in the light of an emergency and should be performed in all cases. The social status must be considered in the knee and hip, except in the young prior to vocational training, when arthroplasty may be advised in all. The presence of double or polyankylosis seriously complicates but does not contra-indicate arthroplasty; the management must be determined by further observation.

There is no retrograde tendency in successful cases, in fact, there is a gradual improvement in function for two or more years, until approximately normal may be reached, though the impression must not prevail that perfection has been attained. Evolution of the method is still in its infancy and there is yet much to be developed and standardized in surgical technique as well as after-treatment, by comparing and collaborating various methods. But from the results obtained during the past 10 years the future is most encouraging. Arthroplasty has acquired a recognized status in surgery; in other words, has come to stay. The procedure, however, is not at present, and probably never will be, a routine operation to be indiscriminately employed, though the technique may be acquired by any surgeon well trained in bone and joint surgery, who is willing to give sufficient time to a rather intricate problem. WILLIS C. CAMPBELL.



EDWIN B. CRAGIN
1859–1918

MASTER SURGEONS OF AMERICA

EDWIN BRADFORD CRAGIN

EDWIN Bradford Cragin was born in Colchester, Connecticut, October 23, 1859. After a notable career, he died in New York City, October 21, 1918.

He represented the early New England lineage and the early New England ideals to a remarkable degree. His father, Edwin Timothy Cragin, who had been a captain in the Seventh Regiment during the portion of his life which was spent in New York City, died at a comparatively early age in Colchester. His mother, Ardelia Elizabeth Cragin lived to an advanced age. She expressed in her character and activities the fine traditions of New England life. She was a direct descendant of William Bradford, one of the original settlers of the Plymouth Colony, who came to this country in the Mayflower and became the first governor of that colony.

Dr. Cragin's boyhood was passed in Colchester. He entered Yale College in the class of 1882 and there received the degree of A.B. He then spent a year in study and travel in the west. In 1883 he entered the College of Physicians and Surgeons in New York City, and was graduated in 1886, receiving the first Harson purse of five hundred dollars for proficiency in examination. He served his interneship in the Roosevelt Hospital. In June, 1889, he was appointed assistant gynecologist to that institution. In the same year, he was also appointed assistant surgeon to the New York Cancer Hospital. He served regularly in the Roosevelt Hospital on the gynecological division for 10 years, doing a large amount of very successful work there. At the New York Cancer Hospital, he served for 4 years and then resigned.

His services to the College of Physicians and Surgeons were very important. From 1893 to 1895, he was assistant secretary and from 1895 to 1899 he was secretary of the faculty of that institution. In 1898 after the resignation of James W. McLane, he was made lecturer in obstetrics, and in 1899 he was appointed professor of obstetrics in the College and attending obstetrician in the Sloane Maternity Hospital.

For 20 years he carried on the duties of these offices with marked success and ability. During 14 years of this time, the professorship of gynecology was also joined to that of obstetrics. He believed that these departments should not be

separated. His conduct of the joint work of these departments was so successful that in 1909 Mr. and Mrs. William D. Sloane erected at their own expense and provided for the maintenance of a gynecological pavilion for the hospital which bore their name. This institution was then named the Sloane Hospital for Women, instead of the Sloane Maternity Hospital. He thus directed for many years a wonderfully equipped unit of college and hospital work, consisting of the professorship of obstetrics and gynecology and an obstetrical service of 128 beds and a well equipped though smaller gynecological hospital service.

His unusual executive ability enabled him to do this as few men could have done. He was particularly rapid and accurate in his thought and in his action. His decisions and his movements were so rapid and definite that it was difficult really to appreciate how much he was accomplishing or to keep abreast of his work. He was very far sighted in his plans. He had a remarkable capacity for eliminating unessential details and focusing his efforts with wonderful power and rapidity on what was really important. In all things, his procedure was determined by a strong adherence to principle and to the right as he saw it. Nothing could swerve him from his adherence to principle and to duty.

There was a very strong religious element in his character. He was connected with the Central Presbyterian Church for at least 30 years and occupied important offices there. His beneficence was great. He was one of the few men who believed that a tenth of his income should be given to charity in some form or other. His benefactions in the church were large and particularly unostentatious. Those who knew him would occasionally hear in some unexpected way of some of his generous actions. He built a hospital in China and supported a physician in attendance there. This hospital is still carrying on the work which he was so influential in starting. He founded a library in his native town of Colchester. When the war came on, it was his great regret that his health prevented him from going into active service, but he at once gave so large a sum of money for the support of the families of men who were in the service that it was more than sufficient and was in part returned to his estate after the war had closed and thence was used for other benefactions.

As an author, he made many contributions to his specialty. At first in the nature of primary books on gynecology and articles in the periodicals; and then finally by the publication of his treatise on *The Practice of Obstetrics*, a masterful volume of 839 pages which was published in 1916 and is accepted as an authoritative exposition of the subject. His contribution concerning the toxic effects of chloroform during parturition was one of the most valuable contributions of the time.

As a teacher, he was always particularly popular. His statements were clear, the arrangement of his subject was methodical, and he had in marked degree the ability to hold the attention and interest of his audience, with a diction so

clear that there was no question about its meaning, and an enthusiasm which was captivating and inspiring.

Yale University appreciated the notable work which he was doing and in 1907, in response to a request from his classmates, conferred upon him the honorary degree of master of arts. Many important hospitals also appreciated the benefit of his counsel and friendship and elected him to their consulting boards. Among them we may mention the Roosevelt Hospital, the Presbyterian Hospital, the Lincoln Hospital, the Infirmary for Women and Children, the City Hospital, the Nursery and Child's Hospital, and the Italian Hospital, all of them in New York City, and St. Luke's Hospital, Newburgh, New York.

His family life was particularly happy. His marriage to Mary Randall Willard of Colchester occurred in 1889, and they and their children Miriam, Alice, and Edwin Bradford were most congenial. They formed a family circle of the real New England type.

In thus studying the character and actions of this notable man, we find a character of the Puritan type with its strong adherence to duty and right, a very unusual executive ability, ability which would have placed him in the first rank in any occupation which he had sought. We find a great kindliness and generosity, a love for people and an appreciation of their needs, a broad-minded sympathy, a wonderful courage and conviction. He was truly one of nature's noblemen.

After Dr. Cragin's health began to fail in 1916 and 1917, he still kept at his work with great energy, but even his constitution could not withstand the strain and he passed away in the autumn of 1918.

Anyone who witnessed the great honor paid to his memory, at that time, could appreciate that he was one of the great masters among men and among surgeons.

CHARLES N. DOWD.

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

By ALFRED J. BROWN, M.D., F.A.C.S., Omaha, Nebraska

THE FRENCH SURGERY OF DALECHAMPS[1]

THOUGH called a French Surgery the name is somewhat of a misnomer for the subject matter is by no means confined to the common practice of the French Surgeons of the time. Rather it deals with a compilation of the ideas of the early surgeons and adds the work of the later surgeons to whom he refers. It is interesting to note that he reproduces Paré's instruments and refers to him as the first surgeon of the King. This is remarkable for Jacques Dalechamps was of those who considered themselves the elect, while Paré was merely a barber surgeon. Born in 1513 at Bayeux in Caen he apparently had a good fundamental education and then studied at Montpelier, the great university of France, receiving the degree of Doctor in 1547. He then settled in Lyon where he practiced until the time of his death in 1588 and taught medicine in the university. Dalechamps was therefore a surgeon of civil life. There is no record of his serving in the wars, so the probabilities are that he saw little of the true surgery of his time, that of war wounds and trauma. Rather he was the student. He had evidently a fine education in the classics for he is pre-eminent as a translator of the early Greek and Latin surgical literature. To this he devoted much time and among his writings we find translations of the three Books of Galen, of Cælius Aurelianus, of Paulus of Ægina, of Guinterius Andernacensis, of Pliny, and of Dioscordes. In addition to being a surgeon, Dalechamps was a trained botanist. In 1586 he published his General History of Plants in which he systematizes the then knowledge of plants. Here again he is seen as the student and classifier rather than as the research worker in the field of practical nature study. From his prominence in botany he had the honor of having one of the varieties of the Euphorbiaceæ named after him.

In 1570 he produced his book through Guillaume Roville at Lyon which he entitled "French Surgery collected by M. Jacques Dalechamps, Doctor of Medicine, and Lecturer of this Profession at Lyon with many figures of instruments necessary for manual operation." In the Preface to the Reader Dalechamps gives us a glimpse of the controversy going on then as now, as to which of the two major divisions of the healing art, surgery or medicine, is the more important. He, of course, being a surgeon, proves to his own satisfaction at least, that as a therapeutic measure, surgery is of the greater value. This controversy waged for many years, especially in France, and came to such a pass that in 1723 a medal was struck which marked the subordination of Surgery to Medicine.

Following the preface is given a summary of the principal subjects covered in the volume. This summary epitomizes the contents and gives such a clear idea of the volume that I translate it here.

1. The sixth book of Paul of Ægina, in which true surgery is explained, faithfully translated from the Greek.

2. The passages of Æcius in Greek, Cornelius Celsus in Latin, Avicenna and Albucasis in Arabian, which concern the matter treated by Paul.

3. The discourse of Hippocrates concerning fractures of the bones and dislocations of the joints, fully and richly set down, in addition to what Paul has written.

4. The conformity of illustrious and famous practitioners, both of our century and our predecessors to the operations described by Paul.

5. The corrections, annotations, and commentaries on the text of Paul by M. Jacques Dalechamps, of Caen in Normandy, Doctor of Medicine, and Lecturer on Surgery at Lyon.

6. Many illustrations of surgical instruments mentioned by the author or employed by modern surgeons in performing the operations described here.

The whole in our vulgar French, for the benefit of companion and master surgeons who are not versed in Greek and Latin letters.

Dalechamps makes no pretense of originality. He reviews the various surgical procedures and tells what he thinks of them as best he can. Where he has had no personal experience he gives the results of others. He does not always give references to individuals and for this he has been taken to task by some reviewers. But the fact that a graduate of Montpelier gives credit to Paré atones for many omissions: Speaking of amputations he says "M. Ambroise Paré a famous surgeon of our time in the 7th book of his surgery advises the use of the 'bec de corbeau' and needle puncture to arrest the flow of blood after the removal of a member without employing the cautery either actual or potential, which causes extreme pain, fever, syncope, and consumes large amounts of fleshy and nervous parts, by reason of which the bone remains bare and uncovered and often the tissue is not able to cicatrize and an incurable ulcer remains."

[1] Reviewed through the courtesy of the John Crerar Library, Chicago, Illinois.

CHIRVRGIE FRANÇOISE,

RECVEILLIE PAR M. IAQVES DALECHAMPS, Docteur Medicin, & Lecteur ordinaire de ceſte profeſſion à Lyon,

Auec pluſieurs figures des inſtrumens neceſſaires pour l'operation manuelle.

La page 14. contient les principaux chefs de ce qui ſe diſcourt en ceſt œuure.

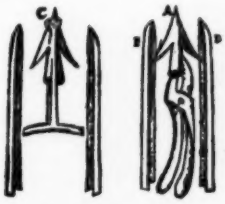
A LYON,
PAR GVILLAVME ROVILLE
M. D. LXX.
Auec priuilege du Roy.

Addideris vocem, fueris Dalechampius *ipſe*,
Expreſſa ad viuum, cuius imago fuit.

Δειξιτον ἐὰν χαρὰν μορφὴν καὶ γόνατα τίθου
Ἐυμαθίλλω σοῦτῳ σοφὰ χειρίδια τέυ.

La maniere comme ſe doit appliquer l'inſtrumẽt au fer, de quelque ſorte qu'il ſoit.

Bec de corbeau.



Canules creuſes.

A. Fer à oreille.
B. Canules pour conduire les aides du fer, qu'elles ne bleſſent les parties par leſquelles le fer ſe tient, lãs attendre à l'os qu'on trepane.

A. Les clauettes qui ſeruent à la dilatation, ou compreſſion du fer, auquel les ailes ſe plient en entrãt dans le corps, & le voulant retirer, s'elargiſſent. B. Fer rond & pointu. C. Le fer dilaté auec ſes ailes. D. Fer tranchant en forme de croiſſant. E. Le fer en forme de trident.

Figure de l'Ectropion, & de l'inciſion neceſſaire vers interieurement qu'exterieurement.

A L'inciſion exterieure faicte de long.
BB L'inciſion interieure faicte de long au droict de l'exterieure.
cc Les deux inciſions obliques.

REVIEWS OF NEW BOOKS IN SURGERY

THE first part of the second volume of the revised edition of Czerney and Keller's[1] book is devoted to the nutritional disturbances of infancy and childhood. As in the first edition, these disturbances are divided into three groups: those due to the food itself, those due to infection, and those due to constitutional abnormalities.

In discussing disturbances due to the food itself the authors retain their original classification which considered these injuries as the result of over-feeding with certain food elements: namely, fat, carbohydrate, or protein. This will be of interest to students of pediatrics inasmuch as the classification of food disturbances as set forth by Finkelstein has perhaps been more generally accepted. The authors however defend their position by stating in the introduction to the present volume that neither their own studies nor the contributions of other writers have in their opinion justified a change in nomenclature. They believe that only further researches which shall change our conception of the nature of nutritional disturbances will warrant a new classification.

The text brings up to date their own life long studies and in addition furnishes a very extensive bibliography. To bring it to the attention of those interested in the subject matter would seem to fulfill the reviewer's task. STANLEY GIBSON.

THE subject of the physical diagnosis of surgical conditions[2] is divided into the following sections: history taking, inspection, palpation, percussion, auscultation, mensuration, and the sense of smell as an aid to diagnosis. Routine laboratory technique and X-ray diagnosis are not included, emphasis being laid on the establishment of a diagnosis at the bedside with the five senses. The book is written especially for students. The descriptions are clear and concise and the illustrations exceptionally good.

Chirurgische Propaedeutick is recommended to medical students who read German or to instructors preparing their courses in surgical physical diagnosis.

RALPH BOERNE BETTMAN.

THE monograph, *The Surgery of Pulmonary Tuberculosis*,[3] by John Alexander won the 1925 quinquennial Samuel D. Gross prize. The work is very complete, covering the whole field of surgical usefulness in pulmonary tuberculosis. The history, indications, technique, and results of all the surgical procedures applicable are discussed in detail. The bibliography, with 500 references, mentions practically all the important publications on the subject.

The reviewer feels that monographs such as this should be encouraged, because in this manner all that is known on any one subject becomes readily available.

As a practical aid to the internist as well as to the surgeon, Alexander's work is to be highly recommended. RALPH BOERNE BETTMAN.

THE work[4] of Evarts Graham while a member of the Empyema Commission of the United States Army was epoch making. As a result of his work our conception of the physiology of the chest and especially of the intrathoracic conditions produced by an open pneumothorax has been revolutionized.

Formerly it was thought that the mediastinum separated the chest into two compartments which as far as intrathoracic pressure was concerned were separate and distinct. Now we know that in the case of an open pneumothorax the chest to all intents and purposes is to be regarded as one cavity, and that both lungs collapse almost equally in the presence of a one sided wide-open thoracotomy wound.

Having established this fact by experiments on lower animals and fresh human cadavers, Graham applied his conclusions to the subject of the treatment of acute empyema.

The terrific mortality of the army camps as well as the high pre-war mortality in civil practice in acute empyema was easily explained in the light of the findings that both lungs collapsed almost equally in the presence of an open thoracotomy. A normal person might tolerate an open pneumothorax, but a patient whose vital capacity was already lowered by the pneumonia concomitant to the empyema would succumb. Therefore Graham advocated either delaying opening the chest cavity until such a time as adhesions might have formed and thus prevent the collapse of the lung, or treating the empyema cavity by some method of closed drainage.

The results were spectacular. The mortality from empyema was reduced from a very high to a relatively low one.

This book is the report and final analysis of Graham's work. The monograph records his experiments and resultant deductions. Every surgeon and physician treating empyema should be thoroughly conversant with this work; and furthermore it should make its appeal to any collector of historic medical monographs, marking as it does one of the milestones in the advance of thoracic surgery.

RALPH BOERNE BETTMAN.

WRITTEN "from the special viewpoint of the student and general practitioner" the work of Dr. Hays[5] on diseases of the ear, nose, and throat

[1] DES KINDES ERNAEHRUNG, ERNAEHRUNGSSTOERUNGEN UND ERNAEHRUNGSTHERAPIE. By Professor Ad. Czerny and Professor A. Keller. Vol. ii, No. 1. Leipzig and Vienna: Franz Deuticke, 1925.

[2] CHIRURGISCHE PROPAEDEUTICK EINE ALLGEMEINE CHIRURGISCHE DIAGNOSTIK FUER STUDIERENDE UND AERZTE. By Professor Dr. Erich Sonntag. Leipzig: Geörg Thieme, 1925.

[3] THE SURGERY OF PULMONARY TUBERCULOSIS. By John Alexander, B.S., M.A., M.D. Philadelphia and New York: Lea and Febiger, 1925.

[4] SOME FUNDAMENTAL CONSIDERATIONS IN THE TREATMENT OF EMPYEMA THORACIS. By Evarts A. Graham, A.B., M.D. St. Louis: C. V. Mosby Company, 1925.

[5] DISEASES OF THE EAR, NOSE, AND THROAT. By Harold Hays, M.A. M.D., F.A.C.S. Philadelphia: F. A. Davis Company, 1925.

well fulfills his design. He has presented those facts required by the average medical man simply and graphically.

Minutiæ of technique, examination, and treatment, often left to be acquired in the clinic, are presented in a way to be easily grasped by men lacking such opportunity. The discussions are generally quite up to date, the illustrations are very numerous, well selected, are quite informative, and help greatly in visualization. For instance, colored plates of transillumination of sinuses and ear-drum appearances in various conditions will be of much aid in interpretation of disease pictures. The drawings and diagrams are generally clear.

The author's well-known interest in the subject of progressive deafness has led to a full and valuable discussion of this condition and of prophylactic and active methods for its relief. There is almost no discussion of moot points, but throughout, the author's views alone are expressed and his chosen methods described. This was perhaps a necessity of space limitation, and occasional dogmatism may be overlooked because, for the most part, well-balanced, conservative views are given. The style is easy and the reading of the text is perhaps less difficult than it would be with more compression.

T. C. GALLOWAY.

A COMPREHENSIVE treatise on urological operative technique[1] is added to the classical works on this subject. Dr. Serés has supplemented the usual descriptions with the results of many personal investigations and modifications which give his book an added scientific value. In the anatomical section the author shows a very intricate knowledge of this field which should place him among the leading present-day anatomists. The recent research on the blood and nerve supply of the kidney is fully elucidated. There is a complete description of the different varieties of renal pelves and calyces with application to the indications and technique of pyelotomy.

Among the surgical procedures described in this book but not included in the standard works are the following: renal plication, utilization of fascia lata for suspension of the kidney, drainage of the space of Retzius through the perineum, a special technique for isolating the ureter and performing ureterolithotomy, subcapsular nephrectomy in cases of lumbar fistula, renal denervation, and subcapsular perineal prostatectomy. The 455 engravings and drawings which illustrate the text are for the greater part original. The text is further illustrated with 8 drawings in color of rare specimens such as a dermoid of the kidney. This work may be consulted with profit by all those interested in the urological specialties.

WILLIAM R. MEEKER.

THE thoroughly revised second edition of Török's *Surgery of the Eye*[2] should justify the labor expended in its preparation. As pointed out by the authors in the preface and by Arnold Knapp in the introduction, most books on ophthalmic surgery have been encyclopedic in nature or have expressed the individual preference of the author for certain operative procedures in a smaller volume. In this book the authors have attempted to describe only those procedures which give the best results. There are 510 illustrations in 102 of which the line of incision is colored. Detailed description and illustration may bore the experienced surgeon but the beginner will welcome the volume for this reason. A definite plan is employed in describing each group of operations: the pathological conditions and methods of examination, indications and contra-indications of each procedure, preparation of instruments and patient, each step of the operation, postoperative care and postoperative complications.

VIRGIL WESTCOTT.

ANYONE interested in the subject of allergy[3] should read this book from cover to cover. It is a thoroughly scientific presentation of a mass of material always interesting, at times fantastic. The point of view is that of the clinician; history and physical examination precedes laboratory examination in diagnostic importance. The skin sensitization tests particularly must be properly interpreted as partial data in the completed story. Despite the intensive point of view, the material is modestly presented. At the risk of being hypercritical we would suggest that in the next edition attention be directed to better punctuation.

SOLOMON STROUSE.

[1] OPERATORIA UROLÓGICA. By Dr. Manuel Serés. With prologue by Dr. D. Sebastian Resacens. Barcelona: Juan B. Aragonés, 1925.

[2] SURGERY OF THE EYE; a Hand-Book for Students and Practitioners. By Ervin Török, M.D., and Gerald H. Grout, M.D. 2d ed. Philadelphia and New York: Lea & Febiger, 1925.

[3] ALLERGY—Asthma, Hay Fever, Urticaria and Allied Manifestations of Reaction. By William W. Duke, Ph.B., M.D. St. Louis: The C. V. Mosby Co., 1925.